No. 80-546

Supreme Court, U. S.
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IN THE

Supreme Court of the United States

OCTOBER TERM, 1980

STUDIENGESELLSCHAFT KOHLE M.B.H., as Trustee for the Max-Planck-Institut für Kohlenforschung,

Petitioner,

—against—

EASTMAN KODAK COMPANY,

Respondent.

PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE FIFTH CIRCUIT

ARNOLD SPRUNG
NATHANIEL D. KRAMER
SPRUNG FELFE HORN LYNCH & KRAMER
600 Third Avenue
New York, New York 10016
Attorneys for Petitioner

Questions Presented for Review

35 U.S.C. §101 entitles an inventor to a patent on a new composition of matter. 35 U.S.C. §271(a) provides that any unauthorized making, using or selling of the patented invention constitutes infringement of the patent. The questions presented in this petition are:

A. Whether the act of making the patented composition, independent of a subsequent use thereof, constitutes an act of infringement under 35 U.S.C. §271(a).

B. Whether the act of using the patented composition in a manner not exemplified in the patent constitutes an act of infringement under 35 U.S.C. §271(a).

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No. ....

STUDIENGESELLSCHAFT KOHLE M.B.H., as Trustee for the Max-Planck-Institut für Kohlenforschung,

Petitioner,

—against—

EASTMAN KODAK COMPANY,

Respondent.

PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE FIFTH CIRCUIT

Studiengesellschaft Kohle m.b.H., as Trustee for the Max-Planck-Institut für Kohlenforschung, petitions for a writ of certiorari to review the judgment of the United States Court of Appeals for the Fifth Circuit in this case.

Opinions Below

The Opinion of the Court of Appeals is reported at 616 F.2d 1315 (5th Cir. 1980). The Opinion of the District Court is reported at 450 F. Supp. 1211 (E.D. Tex. 1977). They appear in the Appendix at pages 1a and 56a.

Jurisdiction

The Decision of the Court of Appeals sought to be reviewed was rendered on May 15, 1980. A timely petition for rehearing was denied on July 8, 1980. The Court of Appeals filed its Judgment on July 25, 1980. This petition was filed within ninety days of both the denial of rehearing and the Judgment of the Court of Appeals. The jurisdiction of this Court is invoked under 28 U.S.C. §1254(1).

Statutes Involved

The relevant statutory provisions are 35 U.S.C. §§101 and 271(a), which read as follows:

"§101. Inventions patentable

"Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."

• • •

"§271. Infringement of patent

"(a) Except as otherwise provided in this title, whoever without authority makes, uses or sells any patented invention, within the United States during the term of the patent therefor, infringes the patent."

Statement of the Case

This is a civil action for infringement of two patents, 3,257,332 (the '332 patent) and 3,826,792 (the '792 patent) brought by the patent owner and petitioner, Studiengesellschaft Kohle m.b.H., as Trustee for the Max-Planck-Insti-

tut für Kohlenforschung, against the Eastman Kodak Company. Federal jurisdiction is based on 28 U.S.C. §§1331 and 1338.

The '332 patent claims the Nobel Prize winning catalysts of Professor Karl Ziegler and his co-workers, which are used to produce plastics and rubbers. The '792 patent claims the process of using these catalysts to polymerize certain petrochemical gases (olefins) into plastics and rubbers. This petition concerns only the '332 patent.

In the early Fifties, Professor Ziegler and his co-workers at the Max-Planck-Institut in Germany discovered that by combining an organoaluminum compound, such as aluminum triethyl, and a heavy metal salt, such as a titanium chloride, new catalysts (compositions of matter) would be formed which showed the remarkable characteristic of being able to easily polymerize ethylene (a petrochemical gas) into a strong, useful plastic, polyethylene.[1] Professor Ziegler, and others who learned of his catalysts, also found these catalysts to be effective for polymerizing other petrochemical gases, such as propylene, the next higher homolog of ethylene, into useful plastics and rubbers.

Development of these catalysts, which became universally known as "Ziegler catalysts," was recognized as a great scientific achievement and advance, opening a whole new field of chemistry, and earned for Professor Ziegler many high scientific awards in addition to the coveted Nobel Prize.

The Ziegler catalysts also achieved unprecedented commercial success, being used to produce billions upon billions of pounds of useful plastics and rubbers. The royalty-paying licensees under the Ziegler catalyst patents in the

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[1] The basic chemistry and terminology involved are described in *Ziegler* v. *Phillips Petroleum Co.*, 483 F.2d 858, 861-66 (5th Cir. 1973) and the decision of the court below at 4a-7a.

United States have included numerous well-known petrochemical giants.

The '332 patent is based on Ziegler's earliest United States and foreign applications covering his catalysts and giving working examples of their use for the polymerization of ethylene. A typical claim of the '332 patent reads as follows:

> "Polymerization catalyst, comprising the product formed by mixing an effective amount of aluminum triethyl with a titanium chloride." [2]

Kodak is accused of infringing the '332 patent by making and using a Ziegler catalyst as covered by this patent. In its plant at Longview, Texas, after making the catalyst, Kodak also uses it to polymerize propylene into polypropylene.[3]

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[2] In conformance with 35 U.S.C. §112, the specification of the '332 patent teaches how to both make and use the claimed catalyst. The claims, however, are composition of matter claims. Corresponding *process* claims, based on the same or expanded teaching, but directed solely to the use of the particular catalyst, are also possible under the patent law. 35 U.S.C. §101, see generally *Application of Kuehl*, 475 F.2d 658, 666 (C.C.P.A. 1973). After the decision of the court in *Ziegler* v. *Phillips Petroleum Co.*, *supra*, a patent incorporating such process claims issued to Ziegler —the '792 patent.

[3] In the earlier *Ziegler* v. *Phillips Petroleum Co.* case, the Fifth Circuit characterized the catalyst as having both composition of matter and process characteristics. This is explainable only on the ground that, in accordance with the particular facts of that case, the catalyst was formed during the reaction, *i.e.*, there was no separate and distinct making and using of the same, and the Court found:

> "There was no convincing proof that the chemical components disclosed in the '332 patent ever combined together in the Phillips process to produce that composition of matter." 483 F.2d at 873.

In contrast thereto, in the instant case, Kodak separately makes its catalyst as a distinct composition of matter prior to its separate use as a polymerization catalyst.

Though Kodak makes its accused catalyst by combining aluminum triethyl and titanium chloride, and though the catalyst is clearly used by Kodak at its plant, nevertheless, the court below declined to find infringement, holding the '332 patent was only infringed by the *use* of the Ziegler catalysts, and only then when the use is for the polymerization of ethylene.[4]

REASONS FOR GRANTING THE WRIT

Introduction

The questions presented are of major importance, involving far-reaching considerations of statutory construction. They require a decision of this Court in order to avoid territorial discrimination under the patent laws caused by inconsistent holdings as between the Fifth and other Federal Circuits.

While a substantial portion of the petrochemical industry is located in the states of the Fifth Circuit, a sizable portion of that industry and other major chemical industries are located outside the Circuit. A fundamentally different view of composition of matter patents, dictating sub-

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[4] Kodak uses a specific form of titanium chloride and adds a third component, lithium butyl, to optimize the yield of the type of polypropylene it commercially desires, but the activity and usefulness of the catalyst is completely dependent upon the presence of the aluminum triethyl and titanium chloride. If either of these essential components is removed from Kodak's catalyst, there is no catalyst, no polymerization and no polypropylene would be formed in Kodak's plant.

Kodak has also suggested that it does not necessarily add the aluminum triethyl directly to the titanium chloride in preparing its catalyst. Its own tests, however, show that regardless of the order of mixing its catalyst components, the resulting catalyst is substantially identical with "little variation in catalyst activity or polymer properties." Obviously, the order of mixing is irrelevant.

stantially narrower readings of patent claims within the circuit, not only discriminates in favor of those companies which have previously located their plants in the Fifth Circuit, but could well lead to future reallocation of enormous amounts of investment capital to plants within the confines of that Circuit at the expense of investment in facilities located in the circuits adhering to the traditional view of the scope of composition of matter patents.

Moreover, the decision below places great uncertainty on the construction which should be given to the many tens of thousands of composition of matter patents presently extant.[5] Such uncertainty will undoubtedly provoke needless, expensive patent litigation.

In addition, it may also cause more inventors to maintain their inventions as trade secrets rather than disclose them to the Patent and Trademark Office in exchange for potentially worthless patents. Such secrecy would be particularly unfortunate in the critical area of petrochemical technology involved herein.

A. *The Making of a Patented Composition of Matter, Without More, Constitutes Infringement Under 35 U.S.C. §271(a)*

It is hornbook law and the law outside the Fifth Circuit that any one of the three acts set forth in 35 U.S.C. §271(a), *i.e.*, the making, using or selling of the patented invention, constitutes an infringement of the patent. Put differently, Section 271(a) has been uniformly interpreted in the disjunctive, so that each making of the patented invention in the United States constitutes a distinct act of infringemen, regardless of the use or sale here. *Neff Instrument*

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[5] It has been conservatively estimated, based on a review of the Official Gazette of the Patent Office at the time of the issuance of the initial Ziegler catalyst patent that there are approximately 75,000 composition of matter patents extant at any given time.

Corp. v. *Cohu Electronics, Inc.*, 269 F.2d 668, 673 (9th Cir. 1959):

> "By the grant of a valid patent, the owner obtains an exclusive right, not only to prevent use by another of his invention, but likewise the making or the selling of the article, in the disjunctive.
>
> • • •
>
> The mere manufacture of a patented article, without sale, is sufficient to create an infringement."

Accord, Caterpillar Tractor Co. v. *International Harvester Co.*, 106 F.2d 769 (9th Cir. 1939); *Bullock Electric & Mfg. Co.* v. *Westinghouse Electric & Mfg. Co.*, 129 Fed. 105, 109 (6th Cir. 1904); *Technicon Instruments Corp.* v. *Coleman Instruments, Inc.*, 255 F. Supp. 630, 641-42 (N.D. Ill. 1966), *aff'd*, 385 F.2d 391 (7th Cir. 1967); 4 D. Chisum on Patents §16.02[3] (1980) (Section 271(a) "codifies the long-standing rule that the making of a patented product without use or sale will constitute infringement.")

Under the decision of the Court of Appeals for the Fifth Circuit complained of herein, however, the plain statutory language of 35 U.S.C. §271(a) has been disregarded and the provision read, instead, as being limited to cover only the *use* of the claimed invention. Indeed, as discussed in Section B, *infra*, it is being further limited to cover only use in a manner expressly exemplified by the patentee, here the use of the pioneering catalyst to polymerize a single reactant, ethylene:

> "we hold that the District Court properly found the '332 patent limited to the polymerization of ethylene." 38a[6]

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[6] This was the *only* ground upon which the court below held the '332 patent non-infringed. *Ibid.*

Under this holding of the Fifth Circuit, the independent acts of making and selling a composition of matter, each a separate act of infringement under the patent statute and the prevailing law outside the Fifth Circuit, would only be relevant if the composition were also put to use, in the United States, in a manner specifically exemplified in the patent, creating the territorial discrimination and uncertainty discussed above. (*Supra* at 5-6)

B. *Any Use of a Patented Composition of Matter Constitutes Infringement of the Patent Under 35 U.S.C. §271(a)*

The holding of the Fifth Circuit is also in conflict with holdings of this Court and other circuits with respect to the statutory interpretation of the term "uses" in 35 U.S.C. §271(a).

In this Court and the courts outside the Fifth Circuit, the term "uses" in 35 U.S.C. §271(a) has been interpreted as encompassing any use of a patented article or composition of matter. Indeed, it has been considered bedrock law that a claim to an article or composition covers *all* uses to which the same may be put.

As this Court noted in *Radio Corp.* v. *Radio Engineering Laboratories, Inc.*, 293 U.S. 1, 14 (1934): the patented apparatus there involved

> "had potencies and values more important than the uses that were immediately apparent, potencies and values at least dimly apprehended, and never discarded or forgotten down to the time of their complete fruition. *The benefit of all alike belonged to the inventor.* 293 U.S. at 14. (emphasis added)

Similarly, the Sixth Circuit ruled in *United Shoe Machinery Corp.* v. *O'Donnell Rubber Products Co.*, 84 F.2d 383, 385 (6th Cir. 1936) that

> "the law is clear that an inventor is entitled to the benefit of all the uses to which his invention may be put whether understood by him or not."

To the same effect is *Ansul Co.* v. *Uniroyal, Inc.*, 448 F.2d 872, 878 (2d Cir. 1971):

> "an inventor who discovers a basic new use is not required to specifically disclose, or even be aware of, all the uses of his invention."

Decisions from other circuits are in accord. *Reinharts, Inc.* v. *Caterpillar Tractor Co.*, 85 F.2d 628 (9th Cir. 1936); *King-Seeley Thermos Co.* v. *Tastee Freez Industries, Inc.*, 357 F.2d 875, 880 (7th Cir. 1966); *King-Seeley Thermos Co.* v. *Refrigerated Dispensers, Inc.*, 354 F.2d 533, 537 (10th Cir. 1965); see 4 D. Chisum on Patents §16.02[4] at 17 (1980)

> "one does not escape infringement by using a patented invention for a purpose not contemplated or disclosed by the patentee." [7]

Uniquely, however, the Fifth Circuit has narrowly interpreted the word "uses" in 35 U.S.C. §271(a) to limit the same to the use specifically exemplified in the disclosure of the patent.

The Fifth Circuit stands alone in this narrow and awkward reading of the patent law, leading to the territorial

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[7] The "all uses" doctrine also operates to limit the proliferation of patents. See *Application of Thuau*, 135 F.2d 344, 347 (C.C. P.A. 1943), which denied a composition of matter patent in view of an earlier patent teaching the same composition of matter, though for other uses:

> "the doctrine is so familiar as not to require citation of authority that a patentee is entitled to every use of which his invention is susceptible, whether such use be known or unknown to him."

discrimination and uncertainty on claim interpretation described in greater detail above.

CONCLUSION

The Court should grant the instant petition for certiorari in order to clarify the conflict between the decision of the Fifth Circuit and the decisions in other jurisdictions, and permit a uniform interpretation of 35 U.S.C. §271(a) on the acts which would constitute infringement of a composition of matter patent, so as to prevent territorial discrimination under the patent laws.

Respectfully,

ARNOLD SPRUNG
NATHANIEL D. KRAMER
SPRUNG FELFE HORN LYNCH & KRAMER
600 Third Avenue
New York, New York 10016

Attorneys for Petitioner

APPENDIX

APPENDIX

Opinion of Court of Appeals

STUDIENGESELLSCHAFT KOHLE mbH, as Trustee for the Max-Planck-Institut fur Kohlenforschung,

Plaintiff-Appellant,

v.

EASTMAN KODAK COMPANY,

Defendant-Appellee.

No. 77-3230

United States Court of Appeals,

Fifth Circuit.

May 15, 1980

Rehearing Denied July 8, 1980

In a suit for infringement of patents involving catalysts for the polymerization of hydrocarbons, the United States District Court for the Eastern District of Texas, Joe J. Fisher, Chief Judge, 450 F.Supp. 1211, ruled that all patents involved in the suit were unenforceable and not infringed. On appeal, the Court of Appeals, Coleman, Chief Judge, held that: (1) suit was not barred by laches and estoppel; (2) certain claims of United States Letters Patent No. 3,826,792 relating to polymerization of propylene or other higher olefins were not invalid; and (3) chemical manufacturer's 409 catalyst process did not infringe United States Letters Patent Nos. 3,257,332 or 3,826,792.

Affirmed in part; reversed in part.

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Opinion of Court of Appeals

Appeal from the United States District Court for the Eastern District of Texas.

Before:

COLEMAN, *Chief Judge,*

FRANK M. JOHNSON, JR. and POLITZ, *Circuit Judges.*

Summary

Studiengesellschaft Kohle mbH (SGK) charged Eastman Kodak Company (Eastman) with infringement of patents obtained by Professor Karl Ziegler covering certain chemical catalysts useful in the polymerization of hydrocarbons. Acting as Trustee for the Max-Planck-Institut für Kohlenforschung, the predecessor in interest to the Ziegler patents, SGK accused Eastman of violating U.S. Letters Patent No. 3,113,115 ('115); No. 3,257,332 ('332); No. 3,231,515 ('515); No. 3,392,162 ('162); and No. 3,826,792 ('792). The alleged infringement took place at Eastman's Longview, Texas, plant, where Eastman used a special catalyst, known as its "409 catalyst" to produce polypropylene. SGK contends that Eastman's process and catalyst employ the teachings of the listed patents, resulting in infringement. Although SGK initially sought an injunction against Kodak's activity, it subsequently sought instead compensation for use by Kodak of SGK's patented invention.

The patents cover catalysts and processes for polymerizing certain hydrocarbons. In essence the patents teach that by mixing certain organometal compounds, particularly an organoaluminum compound, with a compound of a metal of Group IVB, VB, or VIB of the Periodic System of Elements, such as a titanium salt, a polymerization catalyst

would be produced that polymerized olefins much more effectively than was previously possible. SGK sought a broad reading to the patents and an equally large protection against the unlicensed use of the teachings of the patents.

Eastman's 409 process employs a catalyst composed of lithium butyl (LiBu), aluminum triethyl ($AlEt_3$), and hydrogen-reduced alpha titanium trichloride ($H\text{-}\alpha\text{-}TiCl_3$) at a temperature of 160° C. and a pressure of 71 atmospheres to produce polypropylene. SGK contended that this process was directly covered by the patents.

Eastman denied infringement, asserting that it uses additional components not specified in the patents under different conditions to produce a different product. Eastman further asserted that various claims of the patents were invalid because of existing prior art. Finally Eastman argued that SGK's claims were barred by laches.

Prior to trial SGK sought to remove the '115 patent from suit, and the claims based upon it were dismissed with prejudice. Following a two-week trial, the District Court allowed the taking and filing of post-trial depositions and the submission of additional exhibits. It subsequently accepted substantial post-trial briefs and heard lengthy oral argument from both sides. At the conclusion of these extensive proceedings, the Court found that Eastman had not infringed the remaining patents, held that certain claims of the '792 patent were invalid, and concluded, alternatively, that SGK's claims were barred by laches. *Studiengesellschaft Kohle* v. *Eastman Kodak,* 450 F.Supp. 1211 (E.D. Tex. 1977).

Although four patents were at issue in the District Court's opinion, SGK has appealed the trial court's deter-

mination on only the '332 and '792 patents. SGK urges on appeal that the District Court erred (1) in finding the action barred by laches, (2) in failing to find infringement of the '332 and '792 patents, (3) in finding claims 22 to 32 of the '792 patent anticipated by prior art, (4) in holding claims of the '792 patent invalid for failure to comply with various statutory disclosure requirements, (5) in failing to dismiss defendant's "unclean hands" and "inequitable conduct" defenses as not being properly pleaded not properly before the Court, and (6) in arbitrarily and summarily ordering SGK to produce numerous documents previously held privileged by the Special Master.

After an extensive examination of the voluminous record, we find that the suit is not barred by laches, and we affirm the decision of the district court as to the infringement and reverse as to the validity issues. We dismiss SGK's procedural objections as being without merit.

I. BACKGROUND

A. *The Chemistry Involved*

We must begin with a general discussion of the chemistry underlying the patents at issue. The basic principles of the relevant organic chemistry were described in considerable detail in *Ziegler* v. *Phillips Petroleum Co.*, 483 F.2d 858 (5th Cir.), *cert. denied*, 414 U.S. 1079, 94 S.Ct. 597, 38 L.Ed.2d 485 (1973). We review them briefly here.

The simplest hydrocarbon molecule is a compound of one carbon atom and four hydrogen atoms and is commonly known as methane, represented by the chemical symbol CH_4. Because the molecule is bonded together exclusively by single pairs of electrons, methane is known as a saturated

hydrocarbon.[1] The carbon atom in methane may form single bonds with additional carbon atoms, forming other saturated hydrocarbons, such as ethane (C_2H_6), propane (C_3H_8), and butane (C_4H_{10}). These molecules are called members of a homologous series.

Carbon atoms may also bond to each other in double bonds, producing unsaturated hydrocarbons. The simplest of these is ethylene (C_2H_4).[2] The addition of other carbon atoms by single bonds produces another homologous series whose members include propylene (C_3H_6) and butylene (C_4H_8). This unsaturated series is known as the olefin series or as ethylenically unsaturated hydrocarbons. The double bond connecting the adjacent carbon atoms is known as an unsaturated or olefinic bond. In ethylene the double bond must be at the end, but in higher members of the series the unsaturated bond may appear at other locations within the hydrocarbon chain. Where the unsaturated bond occurs at the end of the hydrocarbon chain, the compound is called an alpha olefin.[3]

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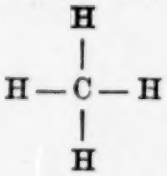
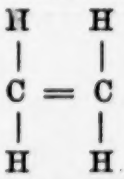
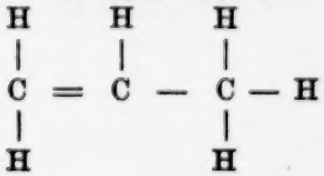
[1] The chemical configuration of CH_4 is diagrammed as follows:



[2] The double bond is represented below:



[3] The following diagram of propylene shows the characteristic location of the double bond in alpha olefins:



The patents in suit claim to teach chemical processes and catalysts which produce synthetic polymers of hydrocarbons. These products are formed by causing hydrocarbon molecules to link together in long chains, called polymers. Thus a synthetic polymer may be produced by causing individual molecules of, say, ethylene to link together into one long chain, called polyethylene. In this case the smaller molecule, ethylene, is called a monomer. Polyethylene is, of course, the polymer. Similar polymers may be produced from other members of the olefin series. The linking of the monomers is termed a polymerization reaction, and the polymerization catalyst is that which causes the monomers to link together to form polymers. A catalyst is defined as a substance which affects the rate or course of a given chemical reaction in some manner without becoming a significant part of the reaction product. Normally, catalysts are used in relatively small amounts as compared with the reactants.

The patents at issue arise from the activities of Dr. Karl Ziegler, who was Director of the Max-Planck-Institut für Kohlenforschung. In 1953 Ziegler and three co-workers discovered that several combinations of an organo aluminum compound and a compound of a metal of Groups IVB, VB, or VIB of the Periodic System of Elements produced polymerization catalysts that polymerized ethylene much more effectively than was previously possible. The catalysts caused monomers to combine in a linear fashion, forming straight and not branched chains, without requiring the formation process to include high pressures or excessive temperatures. Although Ziegler experimented with a number of different compounds, the ones most relevant here are aluminum triethyl and a titanium chloride salt, particularly titanium tetrachloride.

The development of these various polymerization catalysts was recognized as a great scientific achievement, and

Ziegler and his co-workers were awarded the Nobel Prize for their accomplishment. Following his initial success, Ziegler pursued a policy of actively patenting and licensing his new catalyst. In late 1953, he filed German applications Z3799, Z3862, and Z3882 which are the predecessors to the '332 patent before us. In 1954 he filed additional German applications, Z4348, Z4375, Z4629. SGK relies in part on these to sustain the '792 patent.

After his initial discovery, Ziegler continued his experiments with catalysts for a broad range of olefinic polymers. The news of Ziegler's success with polyethylene prompted vigorous research by scientists around the world, as they and Ziegler worked on ways to improve the effectiveness of the catalysts and to polymerize higher members of the series. In Italy Professor Giulio Natta was contemporaneously working in polymer research. Using the catalyst Ziegler had developed, Natta succeeded in polymerizing propylene and in characterizing its stereostructure.

Ethylene is symmetrical and reacts readily to form long linear and uniform polymer chains. Propylene, on the other hand, because of the additional methyl group, is asymmetrical and can form different polymer structures—called stereostructures—depending upon the position the methyl group takes. If the methyl groups in a propylene polymer chain are oriented in a non-uniform or random way, the resulting polymer is soft, pliable, tacky, and amorphous; it is called "atactic." When the methyl groups in the chain are oriented such that they appear repeatedly in the same relative position, the resulting polymer is hard, tough, and highly crystalline. Polypropylene of this "stereoregular" structure is called "isotactic." A catalyst which polymerizes propylene in such a way that the regular "isotactic" stereostructure is preferentially formed is considered a "stereospecific" catalyst.

Natta further discovered that by using a compound of solid crystalline titanium trichloride in the "alpha" form, he was able to polymerize propylene to a polymer very rich in the highly crystalline "isotactic" structure. Because of his work in polymerizing propylene, Natta shared the Nobel Prize with Ziegler. Natta also pursued an active patenting policy.

Meanwhile, Eastman was at work on its own research, directed to developing catalysts that would make good yields of highly crystalline polypropylene of high molecular weight, in a solution process in which the temperature conditions were above 150° C. in order to dissolve the polymer in a hot solvent carrier. Eastman's first commercial catalysts, known at its "402" catalysts, used an alkali metal compound, lithium aluminum hydride ($LiAlH_4$), co-reacted with hydrogen-reduced alpha titanium trichloride ($H\text{-}\alpha\text{-}TiCl_3$).

Although the 402 catalyst produced the product Eastman desired, Eastman sought a more economical catalyst for the manufacture of the same product. This desire led to the development of the 409 catalyst which is the object of this suit. The 409 catalyst is prepared from the co-reaction of lithium butyl (LiBu), aluminum triethyl ($AlEt_3$), and hydrogen reduced alpha titanium trichloride ($H\text{-}\alpha\text{-}TiCl_3$) in mol ratio of 0.3 to 0.3 to 1.0. The 409 catalyst received a plant trial on one of Eastman's three production lines at the Longview plant during the period of April-June 1967. Thereafter, 409 replaced 402 on all production lines.

In April 1974 Eastman entered into a license agreement with Natta's assignee, wherein Eastman received protection under all Natta's basic patents and applications in the polypropylene field.

B. *The Legal Principles*

The issues before us involve both questions of fact and questions of law. The issue of patent infringement is a question of fact, *Ziegler* v. *Phillips Petroleum Co.*, 483 F.2d 858, 867 (5th Cir.) *cert. denied*, 414 U.S. 1079, 94 S.Ct. 597, 38 L.Ed.2d 485 (1973), while the ultimate question of patent validity is one of law, *Bird Provision Co.* v. *Owens Country Sausage, Inc.*, 568 F.2d 369 (5th Cir. 1978). Even when the ultimate issue is a legal one, the conclusion of law must be based on the results of several factual inquiries. *See, e. g., Graham* v. *John Deere Company of Kansas City*, 383 U.S. 1, 17, 86 S.Ct. 684, 693, 15 L.Ed.2d 545 (1966); *Control Components, Inc.* v. *Valtek Inc.*, 609 F.2d 763, 766 (5th Cir. 1980); *Parker* v. *Motorola, Inc.*, 524 F.2d 518, 531 (5th Cir. 1975), *cert. denied*, 425 U.S. 975, 96 S.Ct. 2175, 48 L.Ed.2d 799 (1976).

When the questions involved are factual ones, our review of the District Court's findings must be limited to the "clearly erroneous" standard of Rule 52(a). If the findings of fact are not clearly erroneous, the only issue on appeal is whether the legal conclusion drawn from those facts is correct. *Cathodic Protection Service* v. *American Smelting and Refining Co.*, 594 F.2d 499, 506 (5th Cir. 1979), *cert. denied*, —— U.S. ——, 100 S.Ct. 453, 62 L.Ed.2d 378 (1979); *Kaspar Wire Works, Inc.* v. *Leco Engineering & Machinery, Inc.*, 575 F.2d 530, 543 (5th Cir. 1978). *Fred Whitaker Co.* v. *E. T. Barwick Industries, Inc.*, 551 F.2d 622, 627 (5th Cir. 1977); *Parker* v. *Motorola, Inc.*, 524 F.2d 518, 531 (5th Cir. 1975), *cert. denied*, 425 U.S. 975, 96 S.Ct. 2175, 48 L.Ed.2d 799 (1976); *Ziegler* v. *Phillips Petroleum Co.*, 483 F.2d at 867.

The Supreme Court has emphasized the deference due the findings of the trial court in complex cases, such as

this one "where so must depends upon familiarity with specific scientific problems and principles not usually contained in the general storehouse of knowledge and experience." *Graver Tank & Manufacturing Co.* v. *Linde Air Products Co.*, 339 U.S. 605, 610, 70 S.Ct. 854, 857, 94 L.Ed. 1097 (1950). We have likewise noted that patent cases, because they so frequently contain conflicts in expert testimony, seem particularly suited for Rule 52(a)'s review limitations. *Kaspar Wire Works, Inc.* v. *Leco Engineering & Machinery Inc.*, 575 F.2d at 543; *Bird Provision Co.* v. *Owens Country Sausage, Inc.*, 568 F.2d at 372.

SGK seems to urge that we adopt a more rigorous standard of review because the trial judge "wholly failed to grasp the technology involved or the legal standards set forth in this Court's earlier decision [in *Phillips*]." Brief at 3. Pointing to some of the judge's remarks during the trial, SGK apparently contends that the judge had absolutely no understanding of the factual matters before him. This prompts SGK to assert that "this is one of those unfortunate cases where there was no 'understanding analysis of the evidence' or reasoned application of the law to the facts." Brief at 5. SGK then urges that we apply the principles of *Phillips* to the evidence in the case before us.

We decline SGK's invitation to consider the evidence de novo. The district judge's decision did not come immediately upon the completion of the trial or without further help from counsel in understanding the evidence and the applicable law. Rather, the judge requested extensive post-trial briefs and summaries of the evidence, heard lengthy oral argument from both sides, and took the case under advisement for five months before issuing a lengthy

and detailed opinion. Indeed, the final judgment came almost one year after the conclusion of the trial.

SGK also seems to question the trial court's understanding because of the court's heavy reliance upon the proposed findings Eastman submitted to the court. We note first that the District Court did not adopt Eastman's findings verbatim. There was considerable reworking of Eastman's proposed findings; some were omitted, while others were rearranged, reworded, or otherwise revised. These revisions indicate that the Court was working through the analysis on its own, but finding itself in agreement with Eastman's position. There is absolutely nothing improper with this.

Second, we note that even if the Court had adopted Eastman's proposed findings verbatim, that would not have been sufficient grounds for causing us to engage in a de novo review of the evidence. The clearly erroneous test applies whether the court drafts its own findings of fact or adopts the findings submitted by a party. *Kaspar Wire Works, Inc.* v. *Leco Engineering & Machinery Co.*, 575 F.2d at 543; *Fred Whitaker Co.* v. *E. T. Barwick Industries, Inc.*, 551 F.2d at 627 n. 12; *Keystone Plastics, Inc.* v. *C & P Plastics, Inc.*, 506 F.2d 960, 962-63 (5th Cir. 1975); *see also United States* v. *El Paso Natural Gas Co.*, 376 U.S. 651, 657, 84 S.Ct. 1044, 1047, 12 L.Ed.2d 12 (1964); *Florida Board of Trustees of Internal Improvement Trust Fund* v. *Charley Toppino & Sons, Inc.*, 514 F.2d 700, 703 (5th Cir. 1975).

In view of the foregoing circumstances and case law, we believe that the District Court performed its function adequately in its consideration of the evidence.

As we noted earlier, however, not all the issues in this case are purely factual. In determining whether a patent has been infringed, it is necessary for the court to con-

strue the patent. The construction of a patent is a matter of law, and appellate courts are not bound by the limitations of Rule 52(a) when examining the District Court's construction of the patent. *Fred Whitaker Co.* v. *E. T. Barwick Industries, Inc.*, 551 F.2d at 629 n. 19; *Ziegler* v. *Phillips Petroleum Co.*, 483 F.2d at 867; *Harrington Manufacturing Co., Inc.* v. *White*, 475 F.2d 788, 796 (5th Cir.), *cert. denied*, 414 U.S. 1040, 90 S.Ct. 542, 38 L.Ed.2d 331 (1973). Of course, factual findings may be employed in arriving at the patent's proper construction.

After the court has articulated the scope of the patent by construing it, the court must then explore the infringement issues. In doing so, it may use two analytical techniques, literal infringement and the doctrine of equivalents. As the Supreme Court stated in *Graver Tank & Manufacturing Co., Inc.* v. *Linde Air Products*, 339 U.S. at 607, 70 S.Ct. at 855, "In determining whether an accused device or composition infringes a valid patent, resort must be had in the first instance to the words of the claim. If accused matter falls clearly within the claim, infringement is made out and that is the end of it." See also *Ziegler* v. *Phillips Petroleum Co.*, 483 F.2d at 868; *Williams Bit & Tool Co.* v. *Christensen Diamond Products Co.*, 399 F.2d 628 (5th Cir. 1968). In considering literal infringement, the patent's claims must be read in connection with patent's specification and its file history, and the claims of patent cannot be given a construction broader than the teachings expressed in the patent. *Marvin Glass & Associates* v. *Sears, Roebuck & Co.*, 448 F.2d 60, 62 (5th Cir. 1971); *Kemart Corp.* v. *Printing Arts Research Laboratories*, 201 F.2d 624 (9th Cir. 1953).

As we noted in *Phillips*, however, minor modifications in a patented invention are sufficient to put the item beyond

the scope of literal infringement. In recognition of this fact, courts have developed the doctrine of equivalents to protect patentees from inventions that perform substantially the same function substantially the same way to obtain substantially the same result. *Gaddis* v. *Calgon Corp.*, 506 F.2d 880, 887 (5th Cir. 1975); *Ziegler* v. *Phillips Petroleum Co.*, 483 F.2d at 868; *Phillips Petroleum Co.* v. *Sid Richardson Carbon & Gas Co.*, 416 F.2d 10, 11 (5th Cir. 1969); *Texsteam Corp.* v. *Blanchard*, 352 F.2d 983, 986 (5th Cir. 1965), *cert. denied*, 387 U.S. 936, 87 S.Ct. 2064, 18 L.Ed.2d 1000 (1967); *Up-right Inc.* v. *Safway Products, Inc.*, 315 F.2d 23, 27 (5th Cir. 1963); *Stewart-Warner Corp.* v. *Lone Star Gas Co.*, 195 F.2d 645, 648 (5th Cir. 1952).

Several factors guide the analysis of an infringement claim under the doctrine of equivalents. As the Supreme Court has observed, what constitutes equivalency "must be determined against the context of the patent, the prior art, and the particular circumstances of the case." *Graver Tank & Manufacturing Co., Inc.* v. *Linde Air Products*, 339 U.S. at 609, 70 S.Ct. at 856. In examining the context of the patent itself, the patent claims must be construed in the light of the description and the real invention disclosed in the patent's specifications and examples. The specific facets of the invention described in the patent are guides to objects covered by the patent, but they are not necessarily the exclusive description of the invention. *See Continental Paper Bag Co.* v. *Eastern Paper Bag Co.*, 210 U.S. 405, 419, 28 S.Ct. 748, 751, 52 L.Ed. 1122 (1908); *Ziegler* v. *Phillips Petroleum Co.*, 483 F.2d at 869 and cases cited therein. The nature of the invention itself affects the range of equivalents. A "pioneer" patent, which covers a function ever performed before, receives a much broader protection than a patent which merely makes minor im-

provements upon existing technology. *See* cases cited in *Ziegler* v. *Phillips Petroleum Co.*, 483 F.2d at 869-70. At the same time, the range of equivalents is limited by the patentee's surrender or amendment of claims in response to demands of the patent examiner, so-called "file wrapper estoppel." *Ziegler* v. *Phillips Petroleum Co.*, 483 F.2d at 870; *Williams Bit & Tool Co.* v. *Christensen Diamond Products Co.*, 399 F.2d at 633-34.

II. LACHES AND ESTOPPEL

A. *The Legal Background*

Eastman contends, and the District Court held, that SGK's claims are barred by the equitable doctrines of laches and estoppel. Although this Circuit has had before it a multitude of patent cases, it appears that we have directly addressed these issues only once in the context of a patent, *Shaffer* v. *Rector Well Equipment Co.*, 155 F.2d 344 (5th Cir. 1946). Consequently, we will look to the teachings of other circuits for additional guidance in this area.

At the outset we note that the only statute of limitations involving patent infringement suits merely limits the period of recovery of damages to six years. It does not expressly limit the patentee's right to maintain an action. 35 U.S.C. § 286.[4] *TWM Manufacturing Co., Inc.* v. *Dura Corp.*, 592 F.2d 346, 348 (6th Cir. 1979).

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[4] § 286. *Time limitation on damages*

Except as otherwise provided by law, no recovery shall be had for any infringement committed more than six years prior to the filing of the complaint or counterclaim for infringement in the action.

In the case of claims against the United States Government for use of a patented invention, the period before bringing suit, up

Laches and estoppel are equitable defenses whose appropriateness must be determined in each case under its particular factual situation. *Advanced Hydraulics, Inc.* v. *Otis Elevator Co.*, 525 F.2d 477, 479 (7th Cir.), *cert. denied*, 423 U.S. 869, 96 S.Ct. 132, 46 L.Ed.2d 99 (1975); *Potash Co. of America* v. *International Minerals & Chemical Corp.*, 213 F.2d 153, 155 (10th Cir. 1954); *Shaffer* v. *Rector Well Equipment Co.*, 155 F.2d at 345. Whether the plaintiff should be barred by laches or estoppel is to be determined by the trial judge in the exercise of judicial discretion, and his findings will be revised only if they are clearly erroneous. *Baker Manufacturing Co.* v. *Whitewater Manufacturing Co.*, 430 F.2d 1008, 1009 (7th Cir. 1970), *cert. denied*, 401 U.S. 956, 91 S.Ct. 978, 28 L.Ed.2d 240 (1971); *General Electric Co.* v. *Sciaky Brothers, Inc.*, 304 F.2d 724, 727 (6th Cir. 1962); *Potash Co. of America* v. *International Minerals & Chemical Corp.*, 213 F.2d at 155.

Although laches and estoppel are related concepts, there is a clear distinction between the two. *TWM Manufacturing Co., Inc.* v. *Dura Corp.*, 592 F.2d at 349-50; *Advanced Hydraulics, Inc.* v. *Otis Elevator Co.*, 525 F.2d at 479; *Continental Coatings Corp.* v. *Metco, Inc.*, 464 F.2d 1375, 1379 (7th Cir. 1972). The defense of laches may be invoked where the plaintiff has unreasonably and inexcusably delayed in prosecuting its rights and where that delay has resulted in material prejudice to the defendant. The effect of laches is merely to withhold damages for infringement which occurred prior to the filing of the suit. *Advanced Hydraulics,*

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to six years, between the date of receipt of a written claim for compensation by the department or agency of the government having authority to settle such claim, and the date of mailing by the Government of a notice to the claimant that his claim has been denied shall not be counted as part of the period referred to in the preceding paragraph.

Inc. v. *Otis Elevator,* 525 F.2d at 479; *American Home Products Corp.* v. *Lockwood Manufacturing Co.,* 483 F.2d 1120, 1122 (6th Cir. 1973), *cert. denied,* 414 U.S. 1158, 94 S.Ct. 917, 39 L.Ed.2d 110 (1974); *Shaffer* v. *Rector Well Equipment Co.,* 155 F.2d at 345.

Estoppel, on the other hand, "arises only when one has so acted as to mislead another and the one thus misled has relied upon the action of the inducing party to his prejudice." *Lebold* v. *Inland Steel Co.,* 125 F.2d 369, 375 (7th Cir. 1941); *see also Advanced Hydraulics, Inc.* v. *Otis Elevator Co.,* 525 F.2d at 479; *Armstrong* v. *Motorola, Inc.,* 374 F.2d 764 (7th Cir. 1967). Estoppel forecloses the patentee from enforcing his patent prospectively through an injunction or through damages for continuing infringement. *Advanced Hydraulics, Inc.* v. *Otis Elevator Co.,* 525 F.2d at 479; *Continental Coatings Corp.* v. *Metco, Inc.,* 464 F.2d at 1379; *George J. Meyer Manufacturing Co.* v. *Miller Manufacturing Co.,* 24 F.2d 505, 507 (7th Cir. 1928).

In considering whether plaintiff's delay in litigating his claim makes him guilty of laches, courts use the six-year statutory period for damages as a frame of reference, *TWM Manufacturing Co., Inc.* v. *Dura Corp.,* 592 F.2d at 348; *General Electric Co.* v. *Sciaky Brothers, Inc.,* 304 F.2d at 727; *Whitman* v. *Walt Disney Productions, Inc.,* 263 F.2d 229, 231 (9th Cir. 1958); but laches may also bar a suit brought within the period specified by the corresponding statute of limitations. *Whitman* v. *Walt Disney Productions, Inc.,* 263 F.2d at 232.

Mere delay in bringing suit is not, of itself, sufficient to constitute laches in a patent infringement action. *Maloney-Crawford Tank Corp.* v. *Rocky Mountain Natural Gas Co., Inc.,* 494 F.2d 401, 403 (10th Cir. 1974); *Jenn-Air Corp.* v. *Penn Ventilator Co.,* 464 F.2d 48, 50 (3rd Cir. 1972). In-

stead, two elements must be established: (1) that the delay was unreasonable or inexcusable; (2) that the defendant has suffered injury or prejudice as a result of the delay. *Advanced Hydraulics, Inc.* v. *Otis Elevator Company,* 525 F.2d at 479; *Maloney-Crawford Tank Corp.* v. *Rocky Mountain Natural Gas Co., Inc.,* 494 F.2d at 403; *American Home Products Corp.* v. *Lockwood Manufacturing Co.,* 483 F.2d at 1122; *Jenn-Air Corp.* v. *Penn Ventilator Co.,* 464 F.2d at 50; *Potash Co. of America* v. *International Minerals & Chemical Corp.,* 213 F.2d at 154; *Shaffer* v. *Rector Well Equipment Co.,* 155 F.2d at 345; *Technitrol, Inc.* v. *Memorex Corp.,* 376 F.Supp. 828, 830-31 (N.D.Ill. 1974), *affirmed,* 513 F.2d 1130 (7th Cir. 1975) (per curiam).

Although at one time the courts seemed divided over the relative burdens the parties must bear under a laches defense, recent cases reflect a growing unanimity among the circuits. Where the plaintiff's delay has exceeded the statutory six-year period, the delay is presumed unreasonable, and the plaintiff has the burden of justifying the delay. Similarly, when the delay exceeds six years, injury to the defendant is presumed, and the defendant need not necessarily produce additional evidence of prejudice. *TWM Manufacturing Co., Inc.* v. *Dura Corp.,* 592 F.2d at 349; *Continental Coatings Corp.* v. *Metco, Inc.,* 464 F.2d at 1378; *Baker Manufacturing Co.* v. *Whitewater Manufacturing Co.,* 430 F.2d at 1009; *Technitrol, Inc.* v. *Memorex Corp.,* 376 F.Supp. 828, 831 (N.D.Ill. 1974), *affirmed,* 513 F.2d 1130 (7th Cir. 1975) (per curiam). Where the action is brought within the analogous limitation period, however, the defendant must show both that the delay is unreasonable and that he has suffered injury. *Maloney-Crawford Tank Corp.* v. *Rocky Mountain Natural Gas Co., Inc.,* 494 F.2d at 404. *Jenn-Air Corp.* v. *Penn Ventilation Co.,* 464 F.2d at 50.

To determine the length of plaintiff's delay, the court must look not to the date on which the patent issued but rather to the time at which the plaintiff knew or, in the exercise of reasonable diligence, should have known of the defendant's alleged infringing action. *See TWM Manufacturing Co., Inc.* v. *Dura Corp.*, 592 F.2d at 349 (period of delay begins to run from the notice of infringement given to defendant); *Maloney-Crawford Tank Corp.* v. *Rocky Mountain Natural Gas Co., Inc.*, 494 F.2d at 403 (where known infringement began before plaintiff obtained title to patent, delay is measured from time title was obtained); *Moore* v. *Schultz*, 491 F.2d 294, 300-01 (10th Cir. 1974) (period begins when plaintiff became aware of the possible infringement); *Potash Co. of America* v. *International Minerals & Chemical Corp.*, 312 F.2d at 155 (laches will not be imputed to one who has been justifiably ignorant of facts which create his right of action, but he must be diligent and make such inquiry and investigation as the circumstances reasonably suggest).

The Courts have recognized a variety of factors which constitute prejudice to the defendant because of plaintiff's delay. Chief among these are the fact that important witnesses have died, that the memories of other witnesses have been dulled, that relevant records have been destroyed or are missing, and that the defendant has made heavy capital investments in its facilities in order to expand production connected with the alleged infringing article. *See, e.g., Advanced Hydraulics, Inc.* v. *Otis Elevator Co.*, 525 F.2d at 482; *Continental Coatings Corp.* v. *Metco, Inc.*, 464 F.2d at 1378; *Potash Co. of America* v. *International Minerals & Chemical Corp.*, 213 F.2d at 160; *Brennan* v. *Hawley Products Co.*, 182 F.2d 945, 948 (7th Cir. 1950).

The factors which will excuse delay in bringing an infringement suit are less clear. The chief subject of dispute in this area is the plaintiff's activity in pursuing other infringement suits during the period of delay. Earlier cases stated forthrightly that other infringement litigation justified the plaintiff's delay. In *Clair* v. *Kastar, Inc.*, 148 F.2d 644, 646 (2d Cir. 1945), for example, the Second Circuit stated that "[w]hile a patentee is getting his patent sustained [in another suit] he is not bound to assert his claims to their fullest scope by suing every conceivable infringer." Similarly, the Eighth Circuit, in *Montgomery Ward & Co.* v. *Clair*, 123 F.2d 878, 883 (8th Cir. 1941) held that an inventor "is not required to litigate the validity of his patent against every possible infringer." In *Montgomery Ward*, during the period of delay the plaintiff was litigating the validity of the patent until approximately two months before the suit in question. *See also Jenn-Air Corp.* v. *Penn Ventilator Co.*, 464 F.2d at 50 ("it is sound law . . . that [plaintiff] is not necessarily bound to take on more than one infringer at a time"). In viewing other litigation as a reasonable excuse for delay, the courts have noted that patent litigation is often unusually complex, lengthy, and expensive, and forcing the patentee to litigate simultaneous challenges to the patent's validity could be inequitable. *See American Home Products Corp.* v. *Lockwood Manufacturing Co.*, 483 F.2d at 1123.

More recent cases, however, have rejected the idea that litigation of the patent's validity in another suit is per se sufficient justification for the delay in instituting the current litigation. *See, e.g., American Home Products Corp.* v. *Lockwood Manufacturing Co.*, 483 F.2d at 1123, and *Advanced Hydraulics, Inc.* v. *Otis Elevator Co.*, 525 F.2d at

480, which assert that the existence of other pending litigation over the patent does not automatically excuse delay in the bringing of the suit.

The Seventh Circuit in particular has devoted considerable attention to the matter of pending litigation as a justification for delay. In *Armstrong* v. *Motorola, Inc.*, 374 F.2d 764, the plaintiff had filed suit against RCA in July 1948 and six months later sent a written notice to infringers. He did not sue Motorola until January 1954 when the suit against RCA was still pending. Citing *Montgomery Ward* and *Kastar,* the court pointed out that Armstrong was not required to sue every possible infringer simultaneously, and it held that Armstrong's delay was justified. In *Advanced Hydraulics, Inc.* v. *Otis Elevator Co.*, 525 F.2d 477, the Court reviewed its decision in *Motorola* and rejected appellant's argument that the case stood for the principle that the existence of other pending litigation over the patent is a complete bar to the assertion of a laches defense. The Court pointed out that in both *Motorola* and *Clair,* the infringers had actual notice of the pending litigation, and it limited the holdings to that fact. In *Advanced Hydraulics* no actual notice to the defendant was either alleged or proven, and the court held that the fact of pending litigation did not justify or excuse the delay.[5] The court stated the rule as follows: "notice of 'other litigation' must be given to all known parties who are thought to be infringers; otherwise manifest injustice would result." 525

[5] *Advanced Hydraulics'* finding of no notice to defendants marks a departure from earlier cases which had stated the filing of a suit against another party automatically constituted notice to other infringers. *See, e.g., Montgomery Ward & Co.* v. *Clair,* 123 F.2d at 883 (a suit pending to sustain the validity of a patent is notice to all infringers of the insistence of the patentee upon his claimed rights).

F.2d at 481. *See also TWM Manufacturing Co., Inc.* v. *Dura Corp.*, 592 F.2d at 349 (other litigation involving the same patent but a different adversary should not toll the running of the laches period); *American Home Products Corp.* v. *Lockwood Manufacturing Co.*, 483 F.2d at 1123 (plaintiff pursuing other litigation must assert to the other infringers its intention to bring a subsequent action at the termination of the presently pending action); *Maxon Premix Burner Co., Inc.* v. *Eclipse Fuel Engineering Co.*, 471 F.2d 308, 313 (7th Cir. 1972), *cert. denied*, 410 U.S. 929, 93 S.Ct. 1365, 35 L.Ed.2d 591 (1973) (defendant had full notice that plaintiff intended to enforce its patent rights by reason of plaintiff's earlier infringement action against defendant); *Baker Manufacturing Co.* v. *Whitewater Manufacturing Co.*, 430 F.2d at 1015 (plaintiff involved in other litigation should have at least notified defendant that it was pressing its claim of infringement).

We think the rule outlined by the Seventh Circuit and adopted as well by the Sixth is a proper one. Where the plaintiff is engaged in other litigation involving the patent, to escape a defense of laches he must at least inform the potential infringer of his intent to pursue his rights under the patent.

B. *Application to the Facts*

With this general survey before us, we turn to the facts of the present case. Throughout the early 1960s, Ziegler and his colleagues had several meetings to discuss possible infringement of various Ziegler patents and to consider action against the alleged infringers, including Eastman. Preliminary observations led to the belief that Kodak was infringing the '115 patent (in the initial suit but not in-

volved in this appeal) and in early 1966 Ziegler and Dr. von Kreisler, Ziegler's associate and general patent adviser, discussed the possibility of offering Eastman a license under the '115 patent. In July 1966 von Kreisler wrote Eastman about the '115 patent, and in November 1966 Ziegler formally offered Eastman a license under the '115 patent. Eastman replied that the patent "has no pertinence to our manufacture of polymers" and declined the license offer.[6]

The '332 patent issued on June 21, 1966. Eastman's use of the 409 catalyst at issue in this suit began in the spring of 1967. Prior to that time Eastman's catalyst did not contain an aluminum triakyl, one of the components of the '332 patent. In May of 1967 Ziegler offered Eastman a license under the '332 patent. Eastman promptly rejected the offer for the reasons expressed in its rejection of the

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[6] The letter also stated the following:

> We assume that you and Professor Ziegler are aware that our scientists have developed a number of different catalyst systems for polymerization of α-olefins. You perhaps have seen our various patents and literature articles describing such catalysts. We are convinced that none of them, including our commercial systems, are in any way covered by the claims of U.S. 3,113,115. In any event, Eastman is not using an alkyl aluminum halide at all in its commercial operations.
>
> We suppose that your inquiry has been prompted by publications by our scientists which disclose alkylaluminum dihalide catalysts. Distinctions between this type of catalyst and the type covered by Ziegler's patent are made clear in several publications.
>
> . . .
>
> Again we thank you for the offer of a license. As a company policy we do not knowingly infringe the valid patent rights of others. Therefore, I can assure you that if we had any reason to believe that we needed a license we would seriously consider your offer. However, in the present situation we feel sure that a license is not necessary.

'115 offer.[7] Later in 1967 Ziegler sued Phillips Petroleum on the '332 patent, a suit which put in issue both the scope and the validity of the patent.

In January 1970 Ziegler's American patent attorneys corresponded with Eastman's retained counsel, offering Eastman a license for polypropylene rights under various Ziegler patents. This offer was rejected. By letter of June 3, 1970, Ziegler's counsel indicated their inability to draw a conclusion as to whether Eastman's operations fell within the coverage of Ziegler's patents and asked Eastman to supply information about its operations that would enable Ziegler's counsel to arrive at such a conclusion. Eastman responded by counsel that "these operations are highly proprietary and important to my client and certainly not subject matter which should be imparted to others." Counsel further stated that "having looked into the matter as far as we can, my client sees no necessity for having such a license as you propose and has no interest in entering into negotiations concerning the same." On August 27, 1970, Ziegler's counsel again informed Eastman's counsel that this lack of information rendered a final decision on an infringement action impossible. Counsel pointed out that Ziegler was involved in several litigations involving the '115 and '332 patents and would have to concentrate on those actions. The letter then stated

> We wish to make it perfectly clear, however, on behalf of Professor Ziegler that your client, Eastman Kodak, should not consider any inactivity on Professor Ziegler's part with respect to them at this time

[7] Eastman stated "For the reasons given in my letter of December 22, 1966, we do not see any possibility that Eastman Kodak Company would be interested in a license under Dr. Ziegler's patent."

> an acquiescence to any position which they or you might take with respect to the patent position, and such inactivity is simply due to lack of information concerning your client's activities and the involvement of Professor Ziegler in enforcing his patent rights against others. We wish to make it perfectly clear that at such time when Professor Ziegler is in a position to determine and evaluate the activities of your client, Eastman Kodak, should he determine that in his opinion an infringement situation exists, he will promptly and vigorously enforce his patent rights against Eastman Kodak, and this should be taken into consideration by your client in connection with any continuance or expansion of their activities in the field.

In July 1970, Ziegler sued Dart Industries for infringement of the '115 and '332 patents. The decision in the suit against Phillips became final on December 3, 1973. SGK sued Eastman on March 20, 1974.

The District Court in its conclusions of law determined that the suit was barred by laches and estoppel because Eastman had been prejudiced by SGK's inexcusable and unreasonable delay in filing suit. It found that Eastman had substantially expended its investment and production at the Longview, Texas, plant before institution of the suit. Before any of the patents issued Eastman had expended $11,000,000 and thereafter it expended and additional $6,000,000. According to the court's findings of fact, production was increased from an initial 7,500,000 lbs. per year in 1961 to more than 120,000,000 lbs. per year by the time the complaint was filed. The Court further found that between the issuance of the patents and the institution of the suit, Eastman's production using the 409 catalyst in-

creased about two-fold. As further prejudice to Eastman the Court found that three key participants in Ziegler's patent affairs, including Ziegler himself, had died, and the memory of a fourth had been dulled. Furthermore, the Court concluded that many documents which could have an important bearing on issues raised in the litigation were missing.

Turning to SGK's conduct during the delay, the Court found that SGK was aware of Eastman's commercial entry into the polypropylene market since at least 1963 and that SGK believed throughout the entire period from at least 1964 until suit that Eastman was an infringer of one or more of Ziegler's catalyst patents. At no time during the contacts between Ziegler and Eastman during the 1966-1970 period did Ziegler openly charge infringement or state that Eastman needed a license in order to operate its plant. The Court asserted that none of these contacts was such that Eastman was put in reasonable apprehension of being sued for infringement on the patents in suit. The Court measured the delay from the time the patent issued, finding that the delay on the '332 patent was 7 years, 9 months. Based upon these considerations the Court held that SKG's delay was unreasonable and inexcusable.

We feel that the District Court clearly erred in its analysis of the facts and the application of the law to those facts when it held the action barred by laches and estoppel. We agree that the factors which the Court cited are sufficient to constitute injury and prejudice to the defendant, but we cannot agree that, as a matter of law, the plaintiffs' conduct was unreasonable and inexcusable. From shortly after the time Eastman started using the 409 process until the time of suit, SGK took a number of actions which would indicate that it would pursue its patent rights and that it saw

Eastman as a possible infringer. Its offer of a license indicated that it thought Eastman was employing a process similar to that outlined in the patent. Its several inquiries about Eastman's operation indicated its continuing desire to prosecute its rights and its ongoing suspicion that the Eastman process infringed its patents. At the same time, SGK (through its predecessor Ziegler) was litigating over the '332 patent in two separate suits. Furthermore, it explicitly indicated to Eastman that it was involved in litigation, and warned that those pending suits were not to be seen as the only action it would take to protect its patent rights. This notice came only a little over three years after Eastman began using the 409 process and only four years after the patent issued. Within three months of the conclusion of one of the suits Ziegler was prosecuting, and while the other suit was still pending, SGK filed its suit against Eastman. The facts here seem to fall easily within the bounds of those cases, discussed earlier, where other pending litigation has been a sufficient justification for delay. Here SGK actively sought to protect its patent (it sued Phillips only a year after the patent issued) and gave full notice to Eastman. It is unreasonable on these facts to require it to do more.

Eastman argues that there is no evidence that the existence of litigation prevented Ziegler from instituting the present suit. We know of no appellate case which has established a rule requiring the plaintiff affirmatively to demonstrate that the other litigation prevented the prosecution of a patent claim. Quite the contrary, as we noted earlier, the cases have worked from the assumption that a patentee is not required to litigate against all his potential infringers simultaneously. *See, e.g., Clair* v. *Kastar, Inc.*, 148 F.2d at 646; *Montgomery Ward* v. *Clair*, 123 F.2d at 883. The most

the cases have required, in dicta, is that the defendant be informed of the pending litigation and of the plaintiff's intent to pursue his rights against a possible infringer. *See Advanced Hydraulics, Inc.* v. *Otis Elevator Co.*, 525 F.2d at 481; *American Home Products Corp.* v. *Lockwood Manufacturing Co.*, 483 F.2d at 1123. Those requirements have been met here.

As we pointed out earlier, estoppel—the preclusion of prospective or continuing relief—requires not only delay by the plaintiff and prejudice to the defendant but also misleading action by the plaintiff which causes the defendant to engage in conduct which would result in its injury if the suit were allowed to go forward. The plaintiff must have made representations or engaged in conduct which justifies an inference of abandonment of the patent claim or which has induced the infringer to believe that its business would be unmolested. As the Sixth Circuit observed in *TWM Manufacturing Co., Inc.* v. *Dura Corp.*, 592 F.2d at 350, for silence to work an estoppel, "some evidence must exist to justify an inference that the silence was sufficiently misleading to amount to 'bad faith.'" *See also Continental Coatings Corp.* v. *Metco, Inc.*, 464 F.2d at 1379-80.

Here we can find no misleading conduct by SGK. At no point did SGK indicate or imply that it was abandoning its interest in Eastman's operation. Quite the contrary, SGK's letter of August 27, 1970, explicitly warned Eastman that SGK's failure to pursue the matter immediately could not be viewed as an acquiescence in Eastman's position. Furthermore, throughout much of the period, SGK was prosecuting other possible infringers. Its conduct can hardly be construed as lulling Eastman into a false sense of security. Accordingly, SGK is not estopped from pursuing its action against Eastman.

The '792 patent issued on July 30, 1974, and was asserted against Eastman on July 31, 1974. Although there was no unreasonable delay in bringing suit after the patent issued, Eastman contends, and the District Court held, the conclusion of unreasonable and prejudicial delay is applicable to the '792 patent because SGK purposely and unjustifiably delayed issuance of the patent for eight years in order to extend its monopoly on the use of the '332 catalyst. Because we find that SGK did not unreasonably and inexcusably delay bringing suit on the '332 patent, we must reject the trial court's holding of laches on the '792 claim. Even if the patent had issued at the time of the '332, an action brought on it in 1974, in light of the facts we have articulated would not have been barred.

Because we find that SGK's delay is not unreasonable in light of the foregoing facts, we need not address the question whether Eastman misled SGK in connection with its 409 catalyst.

III. The '332 Patent

The '332 patent, entitled "Polymerization of Ethylene," expressly relates to "new and useful improvements in the polymerization of ethylene for the production of high molecular polyethylenes." According to the teachings of the patent, gaseous ethylene is polymerized into high molecular polyethylenes by contact with a catalyst formed by mixing an aluminum trialkyl compound with a compound of a metal of Group IVB, VB, or VIB of the Periodic System of the Elements. Examples outline the use of catalysts composed of such compounds as aluminum triethyl and titanium tetrachloride.

SGK contends that the '332 patent is not limited to the polymerization of ethylene, but rather includes other olefins,

such as propylene. SGK points to the testimony of one of Professor Ziegler's research colleagues to the effect that at the time Ziegler sought the patent, he understood it to include the polymerization of propylene as well as of ethylene. SGK further argues that Eastman's 409 catalyst infringes the catalyst taught in the '332 patent. Because we conclude that the '332 patent does not extend to the polymerization of propylene, we need not reach the issue of the equivalence of the 409 catalyst with that taught in the Ziegler patent.

A. *Estoppel*

Our consideration of SGK's claims under the '332 must begin with Judge Roney's careful analysis in *Phillips*. There a panel of this court had to address the validity and construction of the '332 patent which is once more before us. In *Phillips* the alleged infringing operation mixed aluminum triethyl, titanium tetrachloride, and iodine in the presence of butadiene to produce polybutadiene.

SGK sought a determination that the '332 patent covered Phillips' operation. We declined to supply that broad a construction to the patent. Rather, we concluded that "any construction of the '332 patent that would encompass a catalyst for the polymerization of butadiene was "untenably broad." We stated that the '332 patent "is limited to the polymeri. :ion of ethylene and was not intended to encompass the formation of high *cis* polybutadiene." 483 F.2d at 875.

Eastman contends that because of our decision in *Phillips*, SGK is estopped from again raising the construction of the '332 patent. According to Eastman, SGK is bound by our assertion that the '332 patent is limited to the polymerization of ethylene. Consequently, Eastman contends, SGK may not assert the protection of the '332 patent against

Eastman's catalyst, which is used to polymerize propylene, not ethylene.

This Circuit has expressed its willingness to discard the rule of mutuality of estoppel, thereby precluding a party from relitigating an issue decided against him in a prior action, even if the party asserting the estoppel was a stranger to the prior action. At the same time, however, we have recognized that a prior litigation will not create estoppel in every circumstance. To give collateral estoppel effect to a prior determination we have required that (1) the issue to be concluded must be identical to that involved in the prior action; (2) in the prior action the issue must have been actually litigated; and (3) the determination made of the issue in the prior action must have been necessary and essential to the resulting judgment. *Matter of Merrill,* 594 F.2d 1064, 1067 (5th Cir. 1979); *Stevenson* v. *International Paper Co., Mobile, Alabama,* 516 F.2d 103, 110 (5th Cir. 1975); *James Talcott, Inc.* v. *Allahabad Bank, Ltd.,* 444 F.2d 451, 458-59 (5th Cir.), *cert. denied,* 404 U.S. 940, 92 S.Ct. 280, 30 L.Ed.2d 253 (1971); *Rachal* v. *Hill,* 435 F.2d 59, 62 (5th Cir. 1970), *cert. denied,* 403 U.S. 904, 91 S.Ct. 2203, 29 L.Ed.2d 680 (1971).

The Supreme Court has articulated similar principles in the patent area in *Blonder-Tongue Laboratories, Inc.* v. *University of Illinois Foundation,* 402 U.S. 313, 91 S.Ct. 1434, 28 L.Ed.2d 788 (1971). There the Court had before it the issue of the effect to be given a prior determination of patent invalidity. The Court explicitly overruled its earlier decision in *Triplett* v. *Lowell,* 297 U.S. 638, 56 S.Ct. 645, 80 L.Ed. 949 (1936), which had held that a determination of patent invalidity is not res judicata against the patentee in subsequent litigation against a different defendant. Noting the arguments in favor of rejecting the doc-

trine of mutuality of estoppel, the Court's decision in *Blonder-Tongue* allowed a defendant charged with infringement to raise a plea of estoppel where the patent in question had been declared invalid in a different adjudication.

At the same time, however, the Court recognized that the estoppel plea may not be employed automatically or too broadly. Rather, the issue must be identical with that presented in the prior adjudication, and the patentee must have had a full and fair chance to litigate the validity of the patent. 402 U.S. at 323, 332-34, 91 S.Ct. at 1444.

We have examined the issue of estoppel in a variety of patent contexts. Our decisions reflect a strong insistence upon strict compliance with the three requirements outlined above. In *Brose* v. *Sears, Roebuck & Co.*, 455 F.2d 763 (5th Cir. 1972), and *Kaspar Wire Works, Inc.* v. *Leco Engineering and Machine, Inc.*, 575 F.2d 530 (5th Cir. 1978), we held that a consent decree in a suit attacking patent validity does not act as collateral estoppel in the absence of clear evidence concerning the parties' intention. As we noted in *Kaspar Wire*, the prior decree "was based entirely on the consent of the parties, and involved neither a judicial determination nor a stipulation of the parties with respect to the validity of [the patent] or its infringement." 575 F.2d at 539-540. In *In re Yarn Processing Patent Validity Litigation*, 498 F.2d 271 (5th Cir.), *cert. denied*, 419 U.S. 1057, 95 S.Ct. 640, 42 L.Ed.2d 654 (1974), we pointed out that in order to invoke estoppel, the issues must be the same as those previously decided. Because we found that the date of invention and the date of reduction to practice were separate issues, only one of which had been adjudicated earlier, we rejected the estoppel argument.

Applying these teachings to the case before us, we conclude that SGK is not estopped from charging Eastman with infringement. We observe at the outset that the validity of the '332 patent is not at issue here. The patent's validity was upheld in *Phillips* and was not challenged by Eastman. The issue is instead whether the '332 patent applies to the polymerization of propylene. The question in *Phillips* was whether the '332 patent extended to the polymerization of butadiene to form high cis-polybutadiene rubber. The two questions are not the same. Unlike propylene, butadiene is a conjugated diolefin whose special properties set it apart from members of the homologous series containing ethylene or propylene. Even if the monomer involved in *Phillips* had been butyene, in light of the different properties possessed by olefins with higher numbers of carbon atoms, a finding that the patent did not cover butylene (C_4H_8) would not necessarily have entailed a determination that it did not cover propylene (C_3H_6).

We acknowledge that language in *Phillips* states that the '332 patent is limited to the polymerization of ethylene. That language, however, is not necessary to the determination of the issue in *Phillips*. Only our holding that the patent was not intended to encompass the formation of high-cis-polybutadiene is necessary.

Because our statements limiting the patent to the polymerization of ethylene are not necessary and essential to the result in *Phillips*, they may not be used as a basis for estoppel in the present case.

B. *Scope of the '332 Patent*

We thus turn to the question whether the '332 patent teaches the polymerization of propylene. The resolution

of this issue is a matter of construction, which is for this Court to decide for itself, but in ascertaining the appropriate construction, we must rely upon certain factual findings of the District Court unless those findings are clearly erroneous. Fed.R.Civ.P. 52(a). As we pointed out in *Phillips,* in construing a patent we look to the claims of the patent itself and to the intention of the patentees. 483 F.2d at 874.

In examining the claims of the patent we find no express teaching concerning the polymerization of propylene. We reaffirm our views in *Phillips* in this regard:

> No intent to claim a catalyst for the polymerization of monomers other than ethylene may be gleaned from the patent as a whole. The '332 patent is entitled "Polymerization of Ethylene;" its preamble states emphatically and succinctly that "[t]his invention relates to new and useful improvements in the polymerization of ethylene for the production of high molecular polyethylenes;" the preamble lists five "Objects of Invention," all five of which deal only with "ethylene" or "polyethylene;" the description preceding the claims focuses solely upon the polymerization of ethylene; and the Examples without exception are limited to the production of "high molecular polyethylenes" from ethylene. 483 F.2d at 874-75.

SGK argues that our analysis and holding in *Phillips* that propylene is a monomer coming within the scope of Ziegler's '115 patent is equally applicable to the Ziegler '332 patent. We disagree. In *Phillips* we went to great pains to point out that the language of the '115 patent expressly covered more monomers than ethylene. First,

the title of the patent ("Polymerization Catalyst") did not limit the claimed catalyst to the polymerization of any particular monomer. Second, the "Objects of Invention" listed in the specification indicated that monomers other than ethylene were within the contemplated scope of the patent. Indeed, the specification stated that the catalyst was for use with lower olefins up to about C_5, which, of course, includes propylene. Third, one of the Examples in the patent expressly encompassed propylene. None of these factors is present in the '332 patent. The '332 patent's title and examples deal only with the polymerization of ethylene. Nowhere in the patent is there mention of the use of the catalyst with monomers other than ethylene.

SGK contends that the '332 patent teaches the polymerization of propylene and ethylene obtained from the cracking of propane and ethane. To support its position, SGK cites to columns 3 and 4 of the patent which state

> Further, in accordance with the invention, instead of pure ethylene, ethylene-containing gas mixtures may be directly used for the polymerization, for example, gases which are generated during the cracking of saturated hydrocarbons, such as ethane or propane, or from mineral oil or its fractions, or generated during similarly conducted Fischer-Tropsch synthesis, and possibly freed from other olefins.

SGK's own expert witness, however did not state that this language taught the polymerization of propylene. Asked by counsel to explain his understanding of the teaching of the '332 patent, Dr. Herman Mark, a chemist, replied in part that "gas mixtures may be polymerized by contacting them with this catalyst, such gas mixtures, for instance,

produced by the cracking of a mixture of ethane or propane, which means ethylene and propylene solvents may be used." Shortly thereafter in his testimony Dr. Mark stated that "at the bottom of Column 3 is stated that gas mixtures—ethylene containing gas mixtures may be directly used for the polymerization and, as an example for such a gas mixture, a mixture of ethane or propane can be used after cracking, which, of course, would indicate that propylene would be present." On cross-examination, Dr. Mark was asked if he could point out where propylene is disclosed as a monomer. He answered, "No, in the '332 patent propylene is not specifically mentioned as a monomer, and it is not actually disclosed in any specific example, so the only reference to the possibility of using propylene is in this sense which I have read." Dr. Mark indicated he was referring to the reference to ethylene-containing gas mixtures, and observed that the cracking of such mixtures would give ethylene and propylene. The following exchange then took place between Dr. Mark and defense counsel:

Q. Is it your opinion that there is a disclosure of propylene as a monomer for utilization with this catalyst?

A. This is not a good disclosure, it is just mentioned, the possibility that propane may be used.

Q. The word "propylene" was known at that time?

A. The word "propylene" doesn't occur in the patent.

Q. But the word "propylene" was known?

A. Sure.

Q. And there wouldn't have been any problem in writing "propylene", if that is the intent, would there?

A. No.

The most that can be made of Dr. Mark's testimony is that the patent teaches that polyethylene may be produced from a gas mixture containing both ethylene and other monomers, including propylene. Such an understanding comports with the stated object of the '332 patent, the polymerization of ethylene. The paragraph merely reveals one more condition under which the polyethylene may be produced. It does not introduce, in a most casual and off-handed way, a new object of the patent. We thus hold that the patent does not expressly teach the polymerization of propylene.

Beyond the actual claims of the patent, SGK contends that Ziegler knew that the '332 catalyst was useful for the polymerization of propylene and had a clear intent of claiming a catalyst for producing polypropylene. SGK further asserts that the evidence presented at trial indicates that the '332 patent was specifically issued with the understanding that its claims covered a catalyst that polymerized propylene into polypropylene. SGK points to the testimony of Dr. Heinz Martin, one of Ziegler's coworkers in Germany. Martin stated that he and his co-inventors knew that the catalyst disclosed in the '332 patent was used for polymerizing propylene and that when the patent issued it was Ziegler's intent that the patent would cover a catalyst for polymerizing propylene.

The issue of the intent and understanding of the patentees is a factual one within the province of the trial court, whose finding will be reversed only if it is clearly erroneous. *Bird Provision Co.* v. *Owens Country Sausage, Inc.*, 568 F.2d 369, 372 (5th Cir. 1978), (findings of fact in patent cases are tested on appeal under the "clearly erroneous" standard of review). Viewing the record as a whole, we cannot conclude that the district judge erred in his determination. Eastman introduced evidence that at the time

Ziegler had completed the invention of the '332 patent in December 1953, Ziegler had not polymerized propylene to solid propylene. Indeed in a patent proceeding in Australia in 1970 Ziegler stated that he had tried to polymerize propylene in his first runs but had failed. Not until July 1954 did he succeed in polymerizing propylene. Although Ziegler had polymerized propylene before he filed the U.S. patent application (but after he had filed in Germany), he made no mention of it in the application. He filed a separate application in Germany covering propylene and subsequently sought to protect the use of his catalyst in polymerizing propylene through a separate U.S. patent application. In this application, S.N. 514068 Ziegler stated that a pending application, S.N. 469059 (which resulted in the '332 patent), "describes a method for polymerizing ethylene to high polymers." Ziegler conceded that "it was not apparent from the work with ethylene that the same or similar catalysts would be useful in the production of high molecular weight polymers of the alpha-olefines [sic] [such as propylene]." Ziegler expressed a similar view of the scope of the '332 patent in other patent applications.

In light of this evidence, the District Court was justified in finding that Ziegler intended to limit the '332 patent to the polymerization of ethylene. Its conclusions in this regard are not clearly erroneous.

Finally an examination of the chemistry involved and the understanding of men skilled in the art leads to the conclusion that the '332 patent teaches only the polymerization of ethylene.

There was expert testimony to the effect that ethylene and propylene, though close members of an homologous series, possess significantly different properties, which could make them respond differently to the '332 catalyst.

These differences are sufficiently important as to preclude the automatic assumption that the polymerization of one with a given catalyst would mean the polymerization of the other with the same catalyst. Dr. C. S. Overberger, a chemist, testified that the first and second members of an homologous series often react quite differently. A polymer of ethylene has only one hydrogen atom attached to the carbon atoms and can exist essentially only in a linear chain form. In polypropylene, on the other hand, a methyl group attaches to every other carbon, which can produce a wide variety of molecular configurations. Indeed, as noted earlier, polypropylene may exist in two general forms, isotactic, which is stereo regular and takes a crystalline form, and atactic, where the methyl groups have less regular arrangement and is amorphous. Ziegler himself, in his patent application S.N. 514068 acknowledged that "the usefulness of a catalyst as initiator for the polymerization of higher homologous of ethylene cannot be predicated on, or assumed from, the usefulness thereof as initiator of ethylene polymerization." Thus even the inventor recognized that a catalyst for ethylene would not automatically be a catalyst for propylene.

After this survey of the patent, the patentee's intent, and the underlying chemistry involved, we hold that the District Court properly found the '332 patent limited to the polymerization of ethylene. Because we find that the production of polypropylene is not encompassed by the patent, we need not address the issue of whether Eastman's 409 catalyst infringes the patented catalyst by the doctrine of equivalents.

IV. The '792 Patent

A. *Validity*

1. *Prior Art*

The District Court held that claims 22 through 32 of the '792 patent—the claims relating to the polymerization of propylene or other higher olefins[8]—were invalid because they were anticipated by the disclosure of prior art as

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[8] The claims in issue are as follows:

22. Method for the polymerization of alpha-olefins, which comprises contacting such olefin with a catalyst formed from an organometal component comprising an aluminum trialkyl and a heavy metal component comprising a compound selected from the group consisting of salts and the freshly precipitated oxides and hydroxides of metals from Groups IV-B, V-B and VI-B of the Periodic System, including thorium and uranium, and recovering a high-molecular polymer formed.

23. Method according to claim 22, in which said heavy metal component is a titanium chloride.

24. Method according to claim 23, in which said organometal component is aluminum triethyl.

25. Method according to claim 22, in which said organometal component is aluminum triethyl.

26. Method according to claim 22, in which said olefin is propylene.

27. Method according to claim 26, in which said heavy metal component is a titanium chloride.

28. Method according to claim 27, in which said organometal component is aluminum triethyl.

29. Method according to claim 22, in which said catalyst is formed by mixing said organometal component and said heavy metal component in the presence of an organic solvent.

30. Method according to claim 29, in which said heavy metal component is a titanium chloride.

31. Method according to claim 30, in which said olefin is propylene.

32. Method according to claim 31, in which said organometal component is aluminum triethyl.

revealed in patent No. 3,582,987 ('987) to Professor Giulio Natta. The '987 patent, entitled "Method for Producing Polymers and Copolymers of Certain Unsaturated Hydrocarbons," teaches the use of a catalyst prepared by reacting titanium tetrachloride with a triethyl aluminum to produce high molecular weight polymers of the higher homologues of ethylene, such as propylene.[9] The '987 patent thus discloses the same catalytic process as that at issue in Ziegler's '792 patent.

According to the District Court, Natta's '987 patent had an Italian filing date of July 27, 1954, while the earliest possible effective invention date of the Ziegler '792 patent was August 3, 1954, the filing date of Ziegler's German application Z4348 covering the polymerization of propylene.[10] Thus the Court found that the Natta patent was prior art, and the Ziegler claims were invalid.

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[9] The abstract of the '987 patent is as follows:

> There is disclosed a process for polymerizing unsaturated hydrocarbons of the formula
>
> $$CH_2=CHR$$
>
> in which R is a saturated aliphatic, an clicylic or an aromatic radical, alone, in mixtures with one another, or in mixtures with small amounts of another monomer copolymerizable therewith. In the formula given, R may be, in specific modifications, an alkyl, cycloalkyl, or aryl radical. The process involves polymerizing the unsaturated hydrocarbons, alone or in the mixtures, in contact with a catalyst prepared from a halide of a transition metal belonging to Groups IV to VI inclusive of the Mendeleeff Periodic Table and an alkyl compound of a metal belonging to Groups II to III of said Table, in the presence of the monomer.

[10] The Ziegler German application states that "with catalysts of identical or analogous type, ethylene homologs may also be converted to plastic-like polymers. This is true particularly for propylene. . . ." The U.S. application in which Ziegler first disclosed the polymerization of homologues of ethylene, S.N. 514,068, was filed June 8, 1955. It stated as one of its objects providing a

Although the existence of a foreign patent is relevant as prior art, *Rosen* v. *Kahlenberg*, 474 F.2d 858, 871 n.7 (5th Cir. 1973), determining whether a particular foreign patent constitutes prior art for purposes of a challenge to the validity of another patent requires an examination of patent law and the judicial constructions placed on that law.

The patent laws outline a series of provisions which will defeat patentability of an invention. 35 U.S.C. § 102. Those which are relevant here are §§102(e) and 102(g). Section 102(e) provides that a person shall be entitled to a patent unless "the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for the patent . . . ." Section 102(g) allows patentability unless "before the applicant's invention thereof the invention was made in this country by another who had not abandoned, suppressed, or concealed it."

Section 119 deals with filings in foreign countries and provides that an application for an American patent by a person who has previously filed a patent application in a foreign country "shall have the same effect as the same application would have if filed in this country on the date

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process "for the production of alpha olefine polymers and copolymers."

The trial court found that the disclosure of the '792 patent was based on an application filed July 1, 1958, that consolidated four earlier patent applications, including S.N. 514,068. An invention is entitled to the earliest priority date of any application which adequately discloses its subject matter. 35 U.S.C. § 120; *Hinde* v. *Hot Sulphur Springs, Colorado*, 482 F.2d 829, 835 (10th Cir. 1973); *Acme Highway Products Corp.* v. *D. S. Brown Co.*, 431 F.2d 1074, 1078-79 (6th Cir. 1970), *cert. denied*, 401 U.S. 956, 91 S.Ct. 977, 28 L.Ed.2d 239 (1971); *Bendix Corp.* v. *Balax, Inc.*, 421 F.2d 809 (7th Cir.), *cert. denied*, 399 U.S. 911, 90 S.Ct. 2203, 26 L.Ed.2d 562 (1970).

on which the application for patent for the same invention was first filed in such foreign country." Eastman contends that this means the Natta '987 patent is effective as a prior art reference as of its Italian filing date. Since that date precedes the filing date of Ziegler's German patent on polypropylene, Eastman argues, the Ziegler claims are invalid.

This Circuit has never explicitly addressed whether the filing date of a foreign patent may be used as the date of filing in the United States for the purposes of showing prior art under § 102(e) and (g). The Court of Customs & Patent Appeals has addressed this general issue, though in somewhat different contexts, on several occasions, and the District of Columbia Circuit has adopted the view articulated by that court. Although we may explore the issue on our own, we are reluctant to disagree with a court whose day-to-day activities require it to interpret and explicate patent law. This is particularly true, where, as here, the C.C.P.A.'s decision is a carefully reasoned examination of the relevant statutory provisions.

In an extensive inquiry into the effect of a foreign filing upon a U.S. patent used as a prior art reference, the Court of Customs and Patent Appeals held that a patent was not effective as a prior art reference under 35 U.S.C. § 102(e) as of its Swiss filing date. Rather, the patent was effective as prior art only as of the U.S. filing date. *Application of Hilmer,* 359 F.2d 859, 53 C.C.P.A. 1288 (1966) (*Hilmer I*). In *Hilmer I* the appellants showed their earliest invention date as July 31, 1957, the date when they filed for a German patent. The patent relied upon as a prior art reference had a U.S. filing date of January 23, 1958, but also had a date of filing in Switzerland of January 23, 1958. The appellants thus could show that their invention occurred

before the U.S. filing of the reference patent but they could not show their invention before the Swiss filing date of the U.S. patent. The Patent Office Board of Appeals gave the U.S. patent effect as prior art as of a foreign filing date. The Court of Customs and Patent Appeals reversed.

The Court pointed out that a patent may be entitled to a foreign filing date for some purposes and not for others. 359 F.2d at 863. Examining the language and legislative history of § 119, which allows a U.S. patent application to be effective as of its foreign filing date, the Court asserted that the purpose of § 119 was in establishing "priority" between parties directly competing for a patent on the same invention. The use of the foreign filing date as a priority right was "a protection to one who was trying to *obtain* patents in foreign countries, the protection being against patent-defeating provisions of national laws based on events intervening between the time of filing at home and filing abroad." 359 F.2d at 873.

Because § 119 was directed to priority between competing parties and § 102(e) was concerned with the elements which would defeat a patent, quite apart from priority disputes between parties, the Court refused to hold that the language in § 119 overrides the express requirement in § 102(e) that a patent relied on as a prior art reference be "*filed in the United States* before the invention" by current applicant. Thus under the *Hilmer I* doctrine, a prior art reference patent is effective only as of its U.S. filing date. The Court of Customs and Patent Appeals implicitly reaffirmed its position in *Hilmer II, Application of Hilmer,* 424 F.2d 1108, 57 CCPA 985 (1970), and *Application of McKellin,* 529 F.2d 1324 (Cust. & Pat. App. 1976). The Court of Appeals for the District of Columbia reached a

similar conclusion in *Eli Lilly & Co.* v. *Brenner*, 375 F.2d 599 (D.C.Cir. 1967).

In *Hilmer II* the Court of Customs & Patent Appeals extended this interpretation to § 102(g). Just as in *Hilmer I* § 119 did not override the "filed in the United States" language of § 102(e), so in *Hilmer II*, § 119 did not remove § 102(g)'s limitation of "in this country." The essence of the Court's view is found in the following statement:

> That [an alleged prior inventor], as an applicant, was entitled to the benefit of his [foreign] filing date does not mean that his invention acquires that same date under § 102(g) as patent-defeating prior art, in direct contravention of the "in this country" limitation of the section. 424 F.2d at 1113.

Eastman contends that our decision in *James B. Clow & Sons, Inc.* v. *United States Pipe & Foundry Co.*, 313 F.2d 46 (5th Cir. 1963) compels us to arrive at a different result. There, however, the issue was who was the first inventor under a priority claim between inventors. An interference between the two inventing parties had been privately settled in an allegedly frauduent manner. In *Clow* we held that private parties could not conclusively settle the question of who the first inventor is, and we directed the trial court to see if the patent owner had properly won the interference, so as to be entitled to a valid patent. We pointed out that the foreign application was not being offered on the issue of anticipation or obviousness. Indeed, Eastman apparently concedes that *Clow* did not reach the issue. Thus our decision in *Clow* reflects the distinction—which is at the heart of this issue in today's case—between the use of a foreign application

to determine priority and the use of a foreign application to establish prior art. We thus join our brethren in the Court of Customs & Patents Appeals in declaring that for purposes of determining whether a patent may serve as a prior art reference under § 102(e) or (g), the effective date is its date of filing in the United States.

Ziegler's German application covering the polymerization of polypropylene was filed August 3, 1954. Natta's U.S. filing occurred on June 8, 1955. Consequently, the Natta patent is not a reference of prior art and cannot render the Ziegler '792 patent invalid.

2. *Other Challenges*

The District Court held the '332 and '792 patents invalid, insofar as they purport to teach catalysts or processes for the polymerization of propylene because (1) the patents fail to contain sufficient description of the invention as to enable any person skilled in the art to which it pertains to make and use the invention; (2) because the patent specifications do not set forth how to make a useful, practical product as required by 35 U.S.C. § 101; and (3) because the inventors did not set forth in their applications the best mode contemplated by them for the practice of their invention as required by § 112. SKG appeals the Court's holding of invalidity on each of these grounds. Since we held that the '332 patent does not teach the polymerization of propylene, we need deal with these issues only in the context of the '792 patent.

The patent statute, 35 U.S.C. § 102, requires that a patent must be directed to subject matter which is "new and useful." Section 112 mandates that a valid patent shall

> contain a written description of the invention, and of the manner and process of making and using it, in such

> full, clear, concise and exact terms as to enable any person skilled in the art to which it pertains . . . to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

In construing this language, the courts have recognized that in meeting the statutory disclosure requirements, it is merely necessary that the patent illustrate some embodiments of the invention and not all of them. *Ziegler* v. *Philips Petroleum Co.*, 483 F.2d 858, 871 (5th Cir.), *cert. denied*, 414 U.S. 1079, 94 St.Ct. 597, 38 L.Ed.2d 485 (1973); *Noll* v. *O. M. Scott & Sons Co.*, 467 F.2d 295, 302 (6th Cir. 1972), and this view has been specifically articulated in the context of patents covering catalysts and catalytic processes. *Application of Angstadt*, 537 F.2d 498, 502-03 (Cust. & Pat. App. 1976); *Application of Bowen*, 492 F.2d 859, 863 (Cust. & Pat. App. 1974).

Eastman argues that the '792 patent fails to provide any teaching of utility. The Supreme Court in *Brenner* v. *Manson*, 383 U.S. 519, 86 S.Ct. 1033, 16 L.Ed.2d 69 (1966), has declared that the practical utility of the compound produced by a chemical process is an essential element in establishing patentability of the process.

The '792 patent provides two examples of the polymerization of propylene. Example 24 describes the production of granular polypropylene. The example then states that "[t]he solid, granular polypropylene may be pressed at 140° C. to obtain flexible sheets or films which appear transparent in thin films and opaque in thick layers." Example 27 outlines the production of a "white, flocculent polypropylene" and states that the polymer "can be easily pressed into foils and rolled into a sheet."

Eastman argues that these descriptions are insufficient to comply with the required demonstration of usefulness. We disagree.

Eastman insists that use of the '792 process fails to produce a useful product because to make a useful polypropylene it is necessary to make and separate the polymer having the isotactic structure, according to the process discovered by Natta. Eastman has found this separation process necessary to produce a polypropylene it can market successfully. It asserts that the Ziegler process does not produce a polymer that Eastman can market. Eastman thus appears to equate "useful" in the sense of the patent law with "useful" in the sense of commercial marketability. We find no reason for imposing a standard of commercial marketability upon the requirements of the patent laws. The product of a patented process is useful if it may serve some identifiable purpose other than merely being the end product of a series of chemical reactions. To require the product to be the victor in the competition of the marketplace is to impose upon patentees a burden far beyond that expressed in the statute.

The decision of the Court of Customs and Patent Appeals in *Anderson* v. *Natta,* 480 F.2d 1392 (Cust. & Pat. App. 1973), relied upon by Eastman, is not controlling. There the Court did state that it was "not convinced that the mere production of a simple film . . . is sufficient to establish usefulness in a practical sense as film," 480 F.2d at 1396-97, but the invention in that case was limited solely to a process for making a very specific copolymer, not here at issue. Moreover, the court's language does not deal with patent disclosure at all, but rather with whether a party had, outside the disclosure of its application, actually reduced the patented invention to practice by making some-

thing successful, so as to be entitled to an invention date even earlier than its application.

More directly on point is a decision by the Patent Office in *Ziegler* v. *Baxter* v. *Natta* (P.O.Bd.Int. 90,833), where the Patent Office held that Ziegler was the first inventor of a specific process directed solely at a method of making polypropylene and that the German equivalent to the '792 patent example 24 disclosed a useful polypropylene. Of course, we are not bound by a decision of the Patent Office, but in this instance we find the logic and reasoning of the Patent Office persuasive and adopt it. Patent '792's disclosure of a transparent or opaque flexible film at 140° C. is a statement of sufficient utility to satisfy the patent statute.

Eastman also challenges the validity of the '792 patent on the grounds that it fails to comply with § 112's requirement that the patent "set forth the best mode contemplated by the inventor of carrying out his invention." SGK and Eastman apparently agree that the '792 patent does not teach how to obtain the highly crystalline, isotactic polypropylene. According to Eastman, this process, discovered by Professor Natta, constitutes the best mode of carrying out the invention. Since Ziegler and his co-workers, as a result of their collaboration with Natta, were aware of Natta's use of α-$TiCl_3$ as a catalyst component, Eastman argues, the trial court was correct in finding that Ziegler failed to set forth the best mode as required by 35 U.S.C. § 112.

In interpreting § 112, the courts have emphasized the obligation of the inventor to disclose the best method contemplated by him to carry out the invention, as of the time he executes his application. *Dale Electronics, Inc.* v.

R. C. L. Electronics, Inc., 488 F.2d 382, 388-89 (1st Cir. 1973); *Application of Glass*, 492 F.2d 1228, 1233-34 (Cust. & Pat.App. 1974); *Application of Gay*, 309 F.2d 769, 50 CCPA 725 (1962); *Benger Laboratories, Ltd.* v. *R. K. Laros Co.*, 209 F.Supp. 639, 644 (E.D.Pa. 1962), *affirmed per curiam*, 317 F.2d 455 (3rd Cir. 1963).

On the other hand, the courts have not required the mode disclosed by the inventor be in fact the optimum mode of carrying out the invention. *Application of Gay*, 309 F.2d at 773. Even if there is a better method, the failure to disclose it will not invalidate the patent if the inventor does not know of it or does not appreciate that it is the best method. *See Benger Laboratories, Ltd.* v. *R. K. Laros Co.*, 209 F.Supp. at 644, *affirmed per curiam*, 317 F.2d at 456. Instead, the thrust of the decisions in this area has been to require that the inventor act in good faith with no attempt to conceal what he feels is the best method of using the invention. *Benger Laboratories, Ltd.* v. *R. K. Laros Co.*, 317 F.2d at 456; *Application of Gay*, 309 F.2d at 772.

From our examination of the record we are unable to find sufficient evidence to justify the conclusion that Ziegler knew that the method employed by Natta was the best mode of carrying out the invention. Neither are we able to conclude that Ziegler acted without good faith or in an attempt to conceal what he believed to be the best use of his catalytic process. Under the statute, Ziegler was not required to disclose every known modification of his process. This is particularly true when those modifications are developed by other people. The mere fact that Ziegler knew of other uses of his catalysts does not create a presumption that he contemplated or appreciated those uses to be the best mode of carrying out his invention. In the absence of evidence that Ziegler felt the use of α-$TiCl_3$ was

the best mode of using his catalyst process, we cannot conclude that the '792 patent is invalid for failure to state the best mode.

SGK finally challenges the District Court's conclusion that the '792 patent is invalid because it does not contain a sufficient description of the invention to enable any person skilled in the art to make and use the invention. We agree with SGK that the District Court incorrectly applied the law in this area.

Claims 23, 24, 27, 28, 30, 31 and 32 of the '792 patent are specific as to the combination of components preferred for propylene polymerization. Furthermore, as a result of the disclosure of Ziegler's process, scientists throughout the world were able to polymerize alpha olefins based on the teachings of the Ziegler method.

Eastman complains that the great majority of the catalysts described in the examples, including many of the "preferred" systems, were shown to be inoperative for polymerizing propylene. Even assuming the truth of this assertion, it does not necessarily follow that the patent is invalid. Such claims encompassing myriad operative combinations are not invalid but are merely construed to exclude those inoperative combinations. *Noll* v. *O. M. Scott & Sons Co.*, 467 F.2d 295, 300 (6th Cir. 1972); *Ansul Co.* v. *Uniroyal, Inc.*, 301 F.Supp. 273, 288-89 (S.D.N.Y. 1969), *affirmed*, 448 F.2d 872, 876-78 (2d Cir. 1971). *See also Application of Bowen*, 492 F.2d 859 (Cust. & Pat.App. 1974). The teachings of the '792 patent adequately describe the invention.

B. *Infringement*

We must now turn to the determinative question: whether Eastman's catalytic process infringes SGK's '972 patent.

SGK's contention, in short, is that the patent, which teaches a catalyst for polymerizing propylene composed of an aluminum trihydrocarbon and a titanium salt, covers a catalyst composed of an aluminum trihydrocarbon, a particular titanium salt, and lithium butyl.

Construing the reach of a patent of this nature is not easy, particularly for non-scientist judges. We must balance the protection to be given the inventor against the need for creativity by others working in the field. We recognize that pioneering patents deserve broad protection, and we likewise note that a patent need not list every imaginable permutation of its components nor need it anticipate every possible modification developed by those who use it. Yet we must be careful not to give one who makes major advances in an area complete control over all subsequent advances and developments in the same area. We must keep in mind the fact that a patentee is entitled to protection against parties who make minor changes in his invention, but we also must not lose sight of the fact that a patent does not give an individual unlimited protection against every conceivable item which may employ some elements of the teaching of the patent. As noted earlier, to come within the scope of the doctrine of equivalents, the challenged process must produce substantially the same result with substantially the same means in substantially the same manner.

With these considerations guiding us, we hold that the District Court properly construed the '792 patent when it found that the patent did not cover Eastman's 409 catalyst. In reaching this conclusion, we are particularly aware of the fact that in catalytic chemistry, minor changes in components, their ratio, or the external condition of the reaction may produce major changes in the reaction itself. A catalyst

which works well at one temperature and pressure, for example, may be totally ineffective at another. Similarly, a small change in the oxidation state of one element of a compound may produce an entirely new catalytic process. Each component of the process—the precise compounds, the ratio of their combination, the external condition of the reaction —may be critical.

Applying these tenets of chemistry to the '792 patent and the 409 process leaves us convinced that the '792 patent should not be construed to cover the 409 process. First, the 409 process contains a component, lithium butyl, which the '792 patent does not mention. Indeed, the '792 patent makes no reference to components other than the aluminum trihydrocarbon and the metallic salt. SGK argues that the complex compound formed by reacting LiBu and $AlEt_3$ produces merely a known and convenient stable form of $AlEt_3$. Thus its addition to the reaction, according to SGK, in no way changes the catalyst. Yet Ziegler filed for different patents where he disclosed new catalysts prepared using complexes such as $LiBu/AlEt_3$ and specifically claimed those complexes. In the absence of testimony, we cannot now conclude that he meant to include those complexes within the '792 patent. In addition, the trial court heard testimony that the presence of LiBu made a significant difference in the final reaction product.

Second, the 409 process uses a particular form of titanium salt, hydrogen reduced alpha titanium trichloride. To be sure, the patent teaches the use of a titanium salt, and the 409 process employs a titanium salt, but it employs a particular form which is neither described nor suggested in the '792 patent. The patent explicitly teaches the use of titanium tetrachloride, but the trial court heard sufficient expert testimony to justify its conclusion that H-α-$TiCl_3$ is not the

same as the titanium salts mentioned in the patent. The physical properties themselves are different. Titanium tetrachloride is a clear, non-crystalline liquid, while H-α-$TiCl_3$ is a solid, violet-colored crystal. The trial court heard expert testimony that the electron structure of the H-α-$TiCl_3$ differed significantly from that of $TiCl_4$ used in the '792 examples. According to this testimony, the differences between the two structures accounted in part for the much greater amount of isotactic polypropylene produced by the 409 process.

Third, the 409 process co-reacts LiBu, $AlEt_3$, and H-α-Ti Cl_3 in a mol ratio of 0.3 to 0.3 to 1.0. The '792 patent points out the importance of the ratio in determining the kind of polypropylene produced and displays the use of ratios of $AlEt_3$ to $TiCl_4$ of less than 1:1. However, the consequence of these lower ratios is a substantial reduction in the molecular weight of the polymer. To produce high molecular weight polypropylene, such as that sought by Eastman, the patent suggests using a $AlEt_3$ to $TiCl_4$ ratio of 2:1, or providing an excess of $AlEt_3$. The 3:1 ratio employed in the process is yet another indication that there are underlying differences in the chemical reactions generated by the two processes.

Fourth, Eastman conducts its polymerization at 71 atmospheres of pressure and a temperature of 160° C. Once again, the '792 patent states that temperatures and pressures this high will produce polypropylene, but the whole thrust of the patent's teachings is that the catalyst works better at lower temperatures and pressures. The patent states, for instance, that "[i]t is advantageous to work at pressures of 1 to 10 atmospheres." Likewise, the patent notes that temperature is not critical, but adds that it is advantageous to operate "at somewhat elevated tempera-

tures and particularly above about 50° C. Thus in olefin polymerization, as contrasted to prior art processes, the monomer contacted wtih a catalyst in accordance with the invention may be rapidly converted into high molecular polymer even at low pressures of less than 100 atmospheres and temperatures of less than 100° C. Working at temperatures above 250° C. is not advisable because at this temperature the catalysts may decompose to a considerable extent." Thus the Eastman process works best under conditions only marginally effective in the teachings of the patent.

Finally, the 409 catalyst produces a high proportion of isotactic polypropylene, while the '792 produces only minimal quantities. Indeed, for Eastman, that which makes the 409 catalyst attractive is its ability to produce stereoregular polypropylene. The '792 patent, on the other hand, expresses no teaching about its ability to produce stereoregular polymers, and, indeed, most of its product is the amorphous, atactic polypropylene.

All these factors, taken together, lead us to conclude that the District Court's determination on this issue was correct. No single factor by itself is sufficient to put Eastman's 409 beyond the reach of SGK's '792 patent. When they are considered together, however, they depict a process that produces a different result through means that are different and by an operation that is different. The 409 process is not the equivalent of the '792 process. Consequently, Eastman has not infringed SGK's patent.

SUMMARY

We REVERSE those portions of the District Court opinion which held SGK's suit barred by laches and estoppel.

We likewise REVERSE the District Court's determination that certain claims of the '792 patent are invalid.

We AFFIRM the trial court's decision that Eastman's conduct does not infringe either the '332 or the '792 patents.

Findings of Fact and Conclusions of Law

IN THE

UNITED STATES DISTRICT COURT

FOR THE EASTERN DISTRICT OF TEXAS

BEAUMONT DIVISION

Civil Action B-74-392-CA

STUDIENGESELLSCHAFT KOHLE mbH, as Trustee for the MAX-PLANCK-INSTITUT für Kohlenforschung,

Plaintiff,

v.

EASTMAN KODAK COMPANY,

Defendant.

CLEVE BACHMAN, Esq.
Orgain, Bell & Tucker
Beaumont Savings Buildings
Beaumont, Texas 77701

ARNOLD SPRUNG, Esq.
NATHANIEL D. KRAMER, Esq.
Burgess, Dinklage & Sprung
600 Third Avenue
New York, New York 10016
Attorneys for Plaintiff

O. J. WEBER, Esq.
Mehaffy, Weber, Keith & Gonsoulin
1400 San Jacinto Building
Beaumont, Texas 77701

Findings of Fact and Conclusions of Law

FRANCIS T. CARR, Esq.
KENNETH E. MADSEN, Esq.
ALAN T. BOWES, Esq.
Kenyon & Kenyon Reilly Carr & Chapin
59 Maiden Lane
New York, New York 10038

Attorneys for Defendant

FINDINGS OF FACT AND CONCLUSIONS OF LAW

The above-styled and numbered cause came on for trial by the Court and the Court having considered the pleadings, the evidence adduced at the trial and in depositions and documents, the arguments of counsel and stipulations of counsel, and the briefs filed by the respective parties, and having been fully advised, makes and files its findings of fact and conclusions of law.

FINDINGS OF FACT

I. NATURE OF THE SUIT AND JURISDICTION

1. This is a patent infringement suit brought by plaintiff, Studiengesellschaft Kohle, mbH, a German corporation, as Trustee for the Max-Planck-Institut fur Kohlenforschung ("Institute") against defendant, Eastman Kodak Company ("Eastman"), a New Jersey corporation. Plaintiff alleges that defendant, by its manufacture of certain chemical products in its Longview, Texas plant within this District, has infringed the following U.S. patents Nos.: 3,257,332 entitled "Polymerization of Ethylene" (hereinafter the "'332 patent"); 3,231,515 entitled "Catalysts" (hereinafter the "'515 patent"); 3,392,162 entitled "Polymerization of Ethylenically Unsaturated Hydrocarbons" (hereinafter the "'162 patent") and 3,826,792

entitled "Polymerization of Ethylenically Unsaturated Hydrocarbons" (hereinafter the "'792 patent"). Plaintiff originally also charged infringement of U.S. patent No. 3,113,115 entitled "Polymerization Catalyst" (hereinafter the "'115 patent"), but in March 1975 moved to withdraw the '115 patent from suit, which motion was granted with prejudice.

2. Plaintiff possesses legal title to the patents in suit but the Institute is the real owner thereof and has agreed to be bound in this litigation as if joined as a party herein (Undertaking filed September 17, 1976).

3. Defendant asserts that plaintiff is estopped from enforcing the patents in suit because of laches in bringing this action, denies that it has infringed any of the patents, asserts that all patents are invalid and unenforceable on various grounds set out in the Pre-Trial Order and has by counterclaim asserted a claim for breach of confidential duty.

4. Trial was held from September 21, 1976 to October 7, 1976. Extended post-trial depositions and testimony were taken thereafter. The parties have extensively briefed the questions presented. Extended oral argument was granted both parties on April 19, 1977.

5. The four patches in suit all pertain to chemical compositions known as catalysts which find use in processes for the production of certain synthetic polymers. Much of the basic chemical terminology is treated extensively in *Ziegler* v. *Phillips Petroleum Co.*, 483 F.2d 858 (C.A. 5, 1973) at pp. 862-63. It is not repeated here in detail. A

chemical catalyst is a substance which affects the rate and course of a given chemical reaction (e.g., a polymerization) in some manner without becoming a significant part of the reaction product (e.g., polymer). Thus, the use of a chemical catalyst is an integral part of the definition of that particular catalyst. Catalyst activity is unpredictable, and modest changes in catalyst composition can have profound and unpredictable effects on the results obtained.

Much of the testimony concerns the polymerization of ethylene and propylene. Both are olefins, but they differ greatly in their ability to polymerize. The polymerization of propylene is more complicated than that of ethylene and can form two different "stereostructures" of polypropylene. One is an intrinsically amorphous and soft material ("atactic" polypropylene), while the other is a hard crystalline material ("isotactic" polypropylene). The latter alone is of substantial commercial importance. Catalysts having the property of inducing the formation of the "isotactic" structure are called "stereospecific" catalysts.

II. Description of the Patents in Suit

6. The '332 patent is directed to a polymerization catalyst for the polymerization of the monomer ethylene. In general, the catalyst is formed by mixing a first component, an aluminum trialkyl compound (e.g., aluminum triethyl), with a second component, a selected transition metal compound (e.g., titanium tetrachloride). The resulting reaction product is the catalyst. The scope of this patent was previously considered in *Ziegler* v. *Phillips*, 483 F.2d 858 (C.A. 5, 1973).

7. The '792 patent is directed to the process of using the catalyst of the '332 patent and further purports to ex-

tend the '332 patent by applying the use of the same catalysts to the polymerization of higher olefins, e.g., propylene, butene and pentene.

8. The '515 patent purports to be directed to polymerization catalysts for lower olefins (from ethylene up to pentene). The '515 catalyst differs from that of the '332 and '792 patents in that the first component used to prepare the catalyst composition is composed of certain alkali alkyl compounds (e.g., lithium butyl).

9. The '162 patent purports to be directed to the use of the catalysts of the '515 patent to polymerize "ethylenically unsaturated hydrocarbons", which would literally include polymerization of olefins generally, including ethylene up to pentene.

III. The Ziegler Patent Applications

10. The patents in suit are based upon work performed in the laboratories of the Institute during 1953-54, at which time Prof. Karl Ziegler was its Director. This resulted in filing a series of 13 German patent applications which subsequently became the subject of 8 separate U.S. patent applications. Seven of these original U.S. applications were directed solely to the polymerization of ethylene to polyethylene. One application, S.N. 514,068, purported to disclose the polymerization of propylene and other higher olefins. These original U.S. applications were thereafter reorganized and refiled as a series of "consolidated" applications, three of which ultimately led to the patents in suit, as set forth in the table below:

Application S.N.	Filing Date	Original Appls. Consolidated	Patent No. In Suit
745,998	7/1/58	469,059; 527,413, 554,631; 514,068	abandoned
125,151	3/17/71	[refiling of S.N. 745,998 appln.]	'792
745,850	7/1/58	554,609; 554,631; 514,068	'162
745,809	7/1/58	554,609; 554,631	'515

The remaining patent in suit ('332) issued from original application S.N. 469,059.

IV. Eastman's Accused Polypropylene Operation

11. Starting in the mid-1950's and continuing steadily thereafter, Eastman conducted catalyst research which resulted in about 1957 in the development of a catalyst, called "402", made by co-reacting lithium aluminum hydride ($LiAlH_4$) with hydrogen-reduced alpha-titanium trichloride ($H\text{-}\alpha\text{-}TiCl_3$). After continuing research, Eastman, in 1967, developed another lithium-based catalyst called "409". This was used at high temperature (160°C) to produce good yields of highly crystalline, high molecular weight polypropylene. Both the 402 and later the 409 catalysts were used by Eastman to commercially manufacture polypropylene on a large scale at Longview, Texas. The Eastman polypropylene process is unique to the industry.

12. Eastman's 409 catalyst is prepared from the co-reaction of three components: lithium butyl (LiBu), aluminum triethyl ($AlEt_3$) and hydrogen-reduced alpha-titanium trichloride ($H\text{-}\alpha\text{-}TiCl_3$), in a mol ratio of 0.3 to 0.3 to 1.0, respectively. Eastman's 409 catalyst was itself an invention which was patented as U.S. 3,679,775.

13. All of the patents in suit are asserted by plaintiff to be infringed in certain respects by Eastman's use of the 409 catalyst and process to make the highly crystalline, high molecular weight polypropylene, and to co-polymerize propylene with small amounts of ethylene (about 1%) to form a modified polypropylene product which Eastman calls "polyallomer".

V. Defense of Laches and Estoppel

A. *Eastman's Commercial Polypropylene Activities*

14. Eastman erected its polypropylene plant in 1961 at a cost of $7,087,000. Thereafter, the plant was continuously enlarged and production increased. Before issuance of any of the patents in suit, Eastman had expended $11,000,000 on its plant and thereafter it expended an additional $6,000,000. Production was increased from an initial 7,500,000 lbs. per year in 1961 to more than 120,000,000 lbs. per year by the time the complaint herein was filed. Since issuance of the '515, '332 and '162 patents and prior to the present suit, Eastman's production using the 409 catalyst has increased about two-fold, i.e., by about 75,000,000 lbs. per year.

B. *Ziegler's Awareness of Eastman's Commercial Activities*

15. Plaintiff was aware of Eastman's commercial entry into the polypropylene market since at least 1963. Although plaintiff claims not to have known the identity of the specific catalyst used by Eastman, it nonetheless believed throughout the entire period from at least 1964 until suit that Eastman was an infringer of one or more of Ziegler's catalyst patents. When plaintiff instituted this suit in March 1974, it knew as much about the specific catalyst

and process used by Eastman as at any earlier time. Lack of specific knowledge of Eastman's 409 catalyst was not a deterrent to suit.

16. While there were sporadic contacts between Eastman Kodak and Ziegler during 1966-1970, at not time did Ziegler openly charge infringement, nor did he at any time state that Eastman needed a license in order to legally operate its plant. None of these contacts was such that Eastman was put in reasonable apprehension of being sued for infringement of any patent now in suit. No actual notice of infringement was given to Eastman prior to the institution of this suit in March 1974.

17. Plaintiff presented no evidence that the existence of other litigation prevented it from sooner instituting the present suit. It had both the manpower and resources to engage in multiple litigation and in fact did so.

18. Plaintiff's delays from the date of issuance of the patents in suit until their actual assertion against Eastman were:

Patent In Suit	Date of Issuance	Date Asserted	Delay
'115	12/03/63	3/29/74	10 years, 3 months
'515	1/25/66	5/06/74	8 years, 4 months
'332	6/21/66	3/29/74	7 years, 9 months
'162	7/09/68	5/06/74	5 years, 10 months
'792	7/30/74	7/31/74	1 day

C. *The Losses of Witnesses, Memories and Documents*

19. There are four key participants in Ziegler's patent affairs whose testimony was no longer available to Eastman, specifically, Prof. Karl Ziegler (deceased), Dr. An-

dreas von Kreisler (deceased), Dr. Ralph Dinklage (poor memory) and Col. Harry Toulmin (deceased).

20. Prof. Ziegler was the head of the Institute, the principal inventor, the guiding genius, and title holder of the patent rights. He was in complete personal control of obtaining, using and enforcing the patent rights until his death in August 1973. Ziegler decided what to file and where. He designated the inventors and wrote the applications.

21. The other participants possessed vital information which is no longer available. All were patent advisors who assisted Ziegler in various critical phases of his efforts to define, obtain and enforce the patents in suit. The evidence they could have given was not shown to be available from any other source.

22. In lieu of the above four witnesses, plaintiff offered as the most knowledgeable witness now available, Dr. Heinz Martin, a co-patentee and the manager of plaintiff. He has a large financial interest in the outcome of this litigation. His knowledge of the 20-year old history of Ziegler's work and patent affairs was quite incomplete and secondhand. He was frequently unable to explain why certain actions were taken in connection with the prosecution of various Ziegler patent applications.

23. Many documents are missing which could have an important bearing on issues raised by defendant in the litigation. Ziegler's internal documents relating to studies of Eastman's catalyst systems, to Eastman's alleged infringement, and to Ziegler's decision concerning suit

against Eastman in 1967 do not exist. In addition, contemporaneous written statements prepared by Ziegler's alleged co-inventors setting forth their views on their respective inventive contributions, and Prof. Ziegler's own written statement setting forth his views on the contributions to the inventions by the alleged co-inventors, are missing. The entirety of von Kreisler's own files have been destroyed.

24. Eastman has been prejudiced by plaintiff's delay because of the significant and continuing investment in its plant and expansion of its facilities, the loss of evidentiary material pertinent to the issues in this litigation through the death of or loss of memory by key witnesses and the loss or destruction of key documents. Further prejudice resulted to Eastman because of the unusually long periods of time the patents in suit were pending prior to issuance. Therefore, in view of the total circumstances, plaintiff's long delay in instituting suit after issuance of the '332, '515 and '162 patents was unreasonable.

D. *The Delay in Issuance of the '792 Patent*

25. The subject matter leading to the claims of the '792 patent was pending in the Patent Office for about 20 years before the patent was issued. At least 8 years of this delay was of plaintiff's own making and was solely due to the plaintiff's attempt to secure a second patent covering essentially the same subject matter that had already been obtained on issuance of the '332 patent in 1966. This unnecessary delay in the issuance of the '792 patent also resulted in prejudice to Eastman on the same basis as given above.

VI. NONINFRINGEMENT

A. *The '332 Patent*

26. Claim 1 of the '332 patent states:

"Polymerization catalyst, comprising the product formed by mixing

[a] an effective amount of aluminum trialkyl with

[b] a compound of a metal selected from the group consisting of

[1] salts, freshly precipitated oxides and hydroxides of

[2] metals of Groups IV-B, V-B and VI-B of the Periodic System, including thorium and uranium."

Thus, claim 1 calls for a catalyst composition made from the reaction of two components, [a] and [b].

(1) *The Polymer*

27. The actual invention of the '332 patent is a catalyst only for the polymerization of ethylene. It does not embrace catalysts for the polymerization of propylene, which was neither disclosed nor contemplated by the patent. Ziegler's initial and subsequent U.S. patent filings demonstrate that he intentionally limited the '332 patent to a catalyst for the polymerization of ethylene.

28. Polypropylene is a product having its own unique characteristics and properties. It is a distinctly different product than polyethylene. Unlike linear polyethylene, polypropylene comes in different structural forms (i.e.,

isotactic, atactic) that have distinct and differing properties.

29. Eastman uses its accused 409 catalyst solely to polymerize propylene to solid highly crystalline polypropylene, or in the case of polyallomer, to produce a modified polypropylene containing no polyethylene. It does not make polyethylene, and hence does not practice the invention of the '332 patent.

(2) *The Catalyst*

30. The '332 patent is directed to the catalytic composition formed when the two components (aluminum triethyl and for example, titanium tetracholoride) are co-reacted to form a new composition of matter. In contrast, the 409 catalyst composition is formed by co-reacting a different combination of three ingredients (LiBu, $AlEt_3$, H-α-$TiCl_3$), using amounts differing from those described in the '332 patent. The active catalyst formed is the integral result of the interactions of all three components, each of which is essential to the composition and behavior of the 409 catalyst. None of the components can be omitted and still produce a catalyst that will yield a satisfactory, useful polymer.

31. Plaintiff has failed to prove that the composition of matter which constitutes the catalyst of the '332 patent is actually ever formed in the preparation of Eastman's 409 catalyst.

32. Though the '332 patent refers generically to "titanium chlorides", the only titanium chloride actually disclosed as useful in the preparation of catalysts is titanium

tetrachloride. The H-α-$TiCl_3$ used by Eastman is a distinctly different material, structurally and chemically, from $TiCl_4$. H-α-$TiCl_3$ is a violet-colored solid having a specific and unique crystal structure, and it is insoluble in the solvents used in the polymerization process. $TiCl_4$ is a clear liquid having no crystal structure, and it is soluble in the solvents used for polymerization. These distinctions are unimportant for the polymerization of ethylene, but are very important for the polymerization of propylene. Because of these structural differences, a catalyst formed using H-α-$TiCl_3$ is capable of making highly crystalline polypropylene whereas one formed with $TiCl_4$ is not. H-α-$TiCl_3$ is not such a titanium chloride as is contemplated by the '322 patent.

33. The 409 catalyst is formed from the integral effect of three components, only one of which ($AlEt_3$) is actually disclosed or contemplated in the '332 patent, and the resulting 409 catalyst composition is not substantially the same as that described and claimed in the '332 patent.

34. The 409 catalyst is not an equivalent of the '332 catalyst. The "means" used by Eastman—its catalyst—has a composition unlike anything contemplated by the '332 patent (Findings, *supra*). A comparison of the "operation" (process) and "result" (polymer) of the use of the 409 catalyst with that of the '332 patent confirm their non-equivalence:

(a) Eastman's 409 catalyst is used in a high temperature process (160°C) to make effective quantities of high molecular weight polypropylene having a high content of isotactic (crystalline) structures. By contrast, the '332 patent does not disclose any high tem-

perature process comparable to that used by Eastman and discloses no catalyst capable of inducing the polymerization of propylene at high temperature or of forming polypropylene of highly crystalline (isotactic) structure.

(b) The behavior of H-α-$TiCl_3$ in the 409 catalyst is unique and critical. Other titanium salts, such as the $TiCl_4$ disclosed in the '332 patent, or even other $TiCl_3$ structures, are not suitable substitutes.

(c) The catalyst disclosed in the '332 patent which is most comparable to the 409 catalyst is that formed from aluminum triethyl plus titanium tetrachloride ($AlEt_3/TiCl_4$). This catalyst is ineffective in making polypropylene under Eastman's process conditions. Conditions can be found under which this '332 catalyst does induce the polymerization of propylene, but the resulting product does not have properties which would make it a useful plastic and it is totally unlike the product of the 409 process.

The 409 catalyst is basically a different catalyst from the invention of the '332 patent.

B. *The '792 Patent*

35. The '792 patent has not before been the subject of any lawsuit. The disclosure of the '792 patent is based on an application filed July 1, 1958 that consolidated four earlier patent applications (See Finding 10, *supra*). Only one of these, S.N. 514,068, disclosed the polymerization of propylene and higher olefins, and it was the first U.S. application of Ziegler et al to do so. It taught that the mol ratio of the two components used to make the catalyst (i.e., the ratio of aluminum compound to heavy metal

compound) was "controlled and critical" within the range of 1 to 1 and 12 to 1, i.e., that the ratio should not be less than 1 to 1. That application also taught that the maximum polymerization temperature is 150°C. However, these limitations of mol ratio and temperature were not referred to when application S.N. 514,068 was later consolidated with the three ethylene applications on July 1, 1958.

36. Since plaintiff contends that the catalyst of the '792 patent is the same as the catalyst of the '332 patent, Eastman does not use the process of the '792 patent because it does not use the catalyst thereof (See Findings 30-34). Unlike the '332, the '792 patent discloses two examples showing the preparation of a polypropylene product. However, the polypropylene which could be made from following the teachings of the '792 patent was shown to lack practical value; it differs substantially in crystallinity, tensile strength, stiffness and softening point from the product of the 409 process. The 409 catalyst and process are neither fairly disclosed nor contemplated by the '792 patent nor could it be considered the equivalent thereof. It is a different and distinct catalyst and process.

37. Plaintiff presented no proofs in support of its allegations of infringement of any of the asserted polyethylene claims of the '792 patent or the '332 patent by reason of Eastman's "polyallomer" manufacture. On the other hand, Eastman showed that its polyallomer was not a polyethylene product as required by the asserted claims of the '792 and '332 patents.

C. *The '515 and '162 Patents*

38. The '515 patent relates to a polymerization catalyst made from the reaction of two components: an alkali alkyl, e.g., lithium butyl (LiBu) and defined transition metal salts, such as titanium tetrachloride ($TiCl_4$). The '162 patent is for the process of using the '515 catalyst and is therefore, in reality, for the same invention. Neither have been in suit before. Neither has been of any practical value or been commercially used by anyone. Ziegler considered them "unimportant".

39. Claim 1 of the '515 patent reads as follows:

"A polymerization catalyst composed of a mixture of a first and second component

[a] said first component being substantially composed of a member of the group consisting of

[1] alkali metal alkyls and aryls;

[2] complexes of

[i] alkali metal alkyls and complexes of alkali metal hydrides with

[ii] a metal organo compound of metals consisting of magnesium and zinc; and

[3] complexes constituted of two metal organo compounds of the group of metals consisting of aluminum, magnesium and zinc,

[b] said second component being a heavy metal compound selected from the group consisting of the salts and the freshly precipitated oxides and hydroxides of the metals of Groups IV-B, V-B and

VI-B of the Periodic System, including the thorium and uranium,

[c] each of said components being present in an amount with respect to the other, to cooperatively act therewith forming an active olefin polymerization catalyst."

Plaintiff has admitted that the scope of the catalyst definition in claim 1 of '162 is the same as that of claim 1 of '515.

40. The 409 and '515/'162 catalyst compositions are not the same:

(a) Plaintiff has failed to show that the catalyst composition of the '515/'162 patents is ever formed in Eastman's accused operations.

(b) Eastman does not use a "first component" that is "substantially composed of" an alkali metal alkyl, e.g., LiBu.

(c) Eastman's H-α-$TiCl_3$ is not a "heavy metal compound" as contemplated by the '515/'162 patents (Compare Finding 32).

(d) The catalyst of the '515/'162 patents is prepared from two components, it does not contemplate the presence of $AlEt_3$ as used in 409. The 409 catalyst is not a mere mixture of two catalysts—one formed from $AlEt_3$ and H-α-$TiCl_3$ and the other from LiBu and H-α-$TiCl_3$.

41. The 409 catalyst and process are not the equivalents of '515/'162. The '515/'162 patents do not disclose any working examples showing the use of the catalyst of the

invention for polymerization of propylene. The catalyst described in the patents that is closest to the 409 catalyst is one formed from LiBu and $TiCl_4$. A composition prepared from these ingredients, using the preferred mol ratio of the patents, is ineffective in polymerizing propylene under Eastman's 409 operating conditions. Eastman's 409 catalyst is operable and useful, while the composition of the '515/'162 patents under similar conditions is not.

D. *File Wrapper Estoppel*

42. As originally filed, the applications leading to the '515 and '162 patents, S.N. 745,809 and S.N. 745,850, respectively, disclosed and claimed a polymerization catalyst (and process utilizing such catalyst) wherein the first component of the catalyst included "complexes of alkali metal alkyls with a metal organo compound of aluminum. . . ." Such a component would include a complex formed from contacting lithium butyl with aluminum triethyl.

43. During the prosecution of Ziegler's applications for the '515 and '162 patents, the Patent Office rejected Ziegler's original claims in view of the prior art U.S. patent No. 2,905,645 to Anderson et al. The Anderson et al patent disclosed a catalyst system wherein the first component used to make the catalyst was a lithium aluminum tetraalkyl. This component is a "complex of an alkali metal alkyl with a metal organo compound of aluminum" as defined in Ziegler's applications.

44. Ziegler determined that the Anderson et al patent directly anticipated the claims of S.N. 745,809 as to the "alkali metal alkyl/organo aluminum complex" catalyst component, and intentionally caused both applications to be amended to exclude such a complex from the scope of the

claims and to thereby avoid conflict with the Anderson patent.

45. The '515 and '162 patents, as issued, reflect this voluntary limitation in the scope of the original claims. The essence of what remained after deletion of aluminum compounds was the combination of an alkali metal alkyl and heavy metal salt, e.g., LiBu/$TiCl_4$, but without $AlEt_3$. See *Application of Ziegler,* 347 F.2d 642 (C.C.P.A. 1965).

46. In the preparation of Eastman's 409 catalyst, the complex formed from mixing an aluminum compound ($AlEt_3$) with lithium butyl (LiBu) is used. Thus Eastman uses the same subject matter given up by Ziegler (LiBu plus $AlEt_3$).

47. The '332 and '792 patents likewise cannot be construed to embrace the catalysts deleted from the '515/'162 patents. Catalysts formed from use of the LiBu-$AlEt_3$ complex were not disclosed nor contemplated in the '332 or '792 patents; rather they were considered by Ziegler et al to be part of the separate and independent invention of the '515/'162 patents from which such catalysts were irretrievably deleted.

VII. Invalidity of the Patents in Suit

A. *Failure to Adequately Disclose or Teach the Polymerization of Propylene*

48. The '332, '515 or '162 patents in suit do not contain any explanation or teaching regarding the process of polymerizing propylene, the nature of any polypropylene product, or how to use it in any practical sense. By comparison, the teachings in these patents concerning the

polymerization of ethylene, the characterization of the polyethylene product and its uses, are full and informative. (Defendant makes no attack as to the adequacy of the teachings pertaining to ethylene).

49. The teachings in the patents in suit regarding the polymerization of ethylene cannot be applied to propylene. It was well known to Ziegler that the behavior of propylene was different than that of ethylene and the reactions of one could not be predicated on the reactions of the other. In addition, while polyethylene was a known commodity at the time of the Ziegler applications, polypropylene was not, and so teachings specific to its preparation, properties and usage were necessary. Experiments showed that most of the catalysts described in the '332, '162 and '515 patents as useful for ethylene polymerization were ineffective when applied to propylene or other higher olefins.

50. The '792 patent contains two examples concerning propylene, but otherwise contains no teachings directed to propylene. The examples describe the polypropylene product sketchily and make no reference to the existence of crystalline structure, or to any practical application of the resulting polymer. Experiments showed that polypropylene polymer made by following the limited teachings of '792 lacked any practical value.

51. No catalyst described in the patents in suit was shown to be capable of making useful, highly crystalline polymers of propylene, or other higher olefins. The claims of all patents embrace catalysts and process conditions that are inoperative for propylene. Excessive experimentation, amounting to inventive acts, would be required to

overcome the deficiency in the teachings of the patents in suit and to discover the actual (undisclosed) catalysts and conditions required to make and recover a useful polypropylene product.

B. *The Lack of Reference to the Known Teachings of Natta et al*

52. The discovery, isolation, and characterization of the important crystalline (isotactic) polypropylene structure was originally made by Prof. G. Natta in mid-1954. Later in 1954 he discovered special catalysts, based on the unique properties of α-$TiCl_3$, that preferentially produced the crystalline isotactic structure. These discoveries, which have been acknowledged by Ziegler, won the Nobel Prize for Natta in 1963, which he shared with Ziegler. Although Ziegler et al were aware of these discoveries at the time they applied for their own U.S. patents, these teachings for obtaining useful highly crystalline polypropylene were not incorporated in the Ziegler et al applications.

C. *Invalidity in View of the Prior Art*

(1) *Effect of Prior Invention by Natta et al on the '792 Patent*

53. Natta et al filed patent applications covering their discoveries on polypropylene first in Italy and then in the United States. This resulted in the grant of several U.S. patents. One of these, U.S. patent No. 3,582,987, discloses a catalyst prepared from aluminum triethyl and titanium tetrachloride that is identical to that defined by the claims of the '792 patent. Natta discloses the use of such a catalyst to polymerize propylene to solid high molecular weight polypropylene.

54. The Natta '987 patent issued on a U.S. application claiming priority of Italian application 25,109/54, filed July 27, 1954. The Italian application contains the same pertinent disclosure as the U.S. application and fully describes the alleged invention of claims 22-32 of the '792 patent. Natta's Italian application antedates the August 3, 1954 filing in Germany of Ziegler et al's priority application Z4348 wherein they first described the polymerization of propylene.

(2) *Effect of the Prior Invention by Fischer on '332 and '792*

55. The record presents substantial conflicting views as to the anticipatory effect of the disclosure of Fischer German patent 874,215. All of this mass of evidence was taken in depositions outside the presence of the Court. Accordingly, the Court is unable to conclude that the defendant has clearly and convincingly overcome the presumed validity of the polyethylene claims of the '792 and '332 patents over the Fischer reference.

(3) *Effect of the Prior Inventions of DuPont Researchers on the '515 and '162 Patents*

56. Contemporaneously with the work being done by Ziegler in his laboratories in Mulheim, Germany in 1954, other researchers in the laboratories of DuPont in Wilmington, Delaware, were also active in the same field. DuPont researchers in 1954 developed a number of catalysts for polymerizing ethylene and other olefins. The use of catalysts formed from alkali alkyl (as a first component) and titanium tetrachloride (as a second component) was conceived in April 1954 and the effectiveness of such

catalysts for polymerizing ethylene to a useful solid polymer was proven at least by August 25, 1954. Other experiments performed by DuPont researchers prior to December 27, 1954 successfully used catalysts formed from lithium butyl and titanium tetrachloride to make useful polyethylene polymer. This DuPont work, which was independent of any knowledge of the corresponding Ziegler work, became publicly known and was not abandoned, suppressed or concealed. The DuPont work fully describes the alleged inventions of the '515/'162 patents. Plaintiff has not proved a conception or reduction to practice in this country of the alleged invention of the '515/'162 patents prior to the December 27, 1954 filing date of the German priority applications Z4628 and Z4629, and thus such inventions were antedated by the DuPont work.

(4) *Effect of Pieper on the '515/'162 Patents*

57. U.S. patent No. 2,867,612 was issued to Pieper et al on January 8, 1959 on application S.N. 558,804 filed October 5, 1955, which claimed priority of German application F 15877 filed October 8, 1954 in Germany. It discloses the polymerization of ethylene to high molecular polyethylene with catalysts formed by mixing titanium tetrachoride with an organic alkali metal compound, such as lithium butyl. The disclosures of German application F 15877 and Pieper '612 are substantially the same in this respect and the October 8, 1954 German priority date of the Pieper patent antedates the priority filing date of December 27, 1954 claimed for the '515 and '162 patents.

(5) *Effect of Anderson Patent on the '515/'162 Patents*

58. U.S. patent No. 2,905,645 was issued to Anderson et al (assigned to DuPont) on September 22, 1959 on application S.N. 450,243 filed August 16, 1954, and thus con-

stitutes prior art against the '515/'162 patents. The '645 patent discloses the production of high molecular polyethylene by catalysts formed from mixing certain titanium compounds, such as $TiCl_4$, with reducing agents such as metal alkyls or aryls and similar organometallic compounds. Lithium butyl is a "metal alkyl" within the scope of the disclosure of the '645 patent. Example VI of the '645 patent uses an ethylene polymerization catalyst that is the same as that of the '515/'162 patents except that the example uses lithium phenyl rather than lithium butyl as a reducing agent for $TiCl_4$. However, it was already known that lithium butyl was also a reducing agent for $TiCl_4$ and behaved like lithium phenyl in this respect. Accordingly, as of August 16, 1954, it would have been obvious to a person of ordinary skill in the art to use lithium butyl in place of lithium phenyl in Example VI of the Anderson '645 patent and thus make the invention of the '515/'162 patents.

(6) *Effect of Prior Art on the '515/'162 Patents to the Extent They Are Construed to Cover Catalysts or Processes for Polymerization of Propylene or Olefins Generally.*

59. The applications for the '515 and '162 patents (S.N. 745,809 and S.N. 745,850 filed July 1, 1958) are the first Ziegler et al applications to disclose *both* alkali metal alkyls and their use as components of catalysts for polymerizing propylene or olefins generally.

60. The invention claimed in the '515 and '162 patents, insofar as such patents purport to cover catalysts and processes for the polymerization of propylene or olefins generally (as distinct from the coverage of ethylene specifically) is fully described in the following patents, all of

which constitute prior art having effective dates before July 1, 1958:

(a) British patent specification No. 785,314, published October 23, 1957.

(b) Belgian patent No. 543,941, granted June 24, 1956.

(c) U.S. patent No. 2,880,199 (Jezl), issued March 31, 1959 on an application filed November 2, 1956.

(d) Spanish patent No. 225,790 published October 1, 1956. This patent is essentially the same as Ziegler's German application Z4628, one of the priority applications for the '515 and '162 patents. It describes a catalyst for the polymerization of ethylene (an "ethylenically unsaturated hydrocarbon") and was granted more than one year prior to July 1, 1958.

D. *Invalidity of the Propylene Claims of '792 in View of Late Claiming*

61. One week after plaintiff gained detailed knowledge of Eastman's 409 catalyst, it filed (on April 30, 1974) independent claim 22 of the '792 patent containing new "comprising" type language. This new claim 22 replaced a prior one directed to a catalyst prepared from two components and sought to substitute therefor one which was susceptible to the construction that it could include additional components. Independent claim 22 of the '792 patent, under those circumstances, cannot be broadly construed as embracing the different three component catalyst used by Eastman since such language was first introduced seven years after Eastman had established intervening usage of its catalyst and two years after a U.S. patent thereon had issued to Eastman.

E. *Invalidity Because of Double Patenting*

62. The '162 patent issued almost 2½ years after the issuance of the '515 patent. These patents differ only in that the '515 patent claims a catalyst composition, while the '162 patent claims the *use* of the same catalyst composition. There is no known utility for the '515 catalyst except in a process as claimed in the '162 patent. One cannot distinguish between the alleged invention of the '515 patent and the alleged invention of the later '162 patent. They are the same.

F. *Invalidity Because of Broadened Construction*

63. Each of the following prior art patents have an effective date prior to July 1, 1958 and disclose the catalysts of the '792, '162 and '515 patents for the polymerization of propylene while using mol ratios of organometal compound to heavy metal (e.g., $AlEt_3$ to $TiCl_4$) of less than 1 to 1 and at temperatures of 150°C or higher:

(a) U.S. patent No. 2,880,199 (filed November 2, 1956).

(b) British patent spec. No. 785,314 (published Oct. 23, 1957).

(c) Belgian patent No. 543,941 (granted June 24, 1956).

G. *"Unclean Hands" Defense*

64. The defendant has asserted various defenses of unenforceability of the patents because of plaintiff's "unclean hands". In light of the Court's disposition of the issues of validity and infringement, it finds it is unnecessary at this time to consider the copious record relating to such additional defenses.

Findings of Fact and Conclusions of Law

H. *Defendant's Counterclaims for Breach*

65. Inasmuch as this Court has concluded that the introduction in April 1974 of the "comprising" type language into the pending '792 claims did not broaden the scope of the pre-existing claims directed to the use of a two component catalyst (Finding 61), and that the issued claims do not embrace the use of the three component catalyst used by defendant, it finds no injury was caused defendant by the language change.

CONCLUSIONS OF LAW

1. This Court has jurisdiction of the subject matter and over the parties to this action. 28 U.S.C. §1338, 2201, 2202; 35 U.S.C. §281.

2. The enforcement of the patents in suit is barred by laches and estoppel because Eastman has been prejudiced by plaintiff's inexcusable and unreasonable delay in filing suit in that Eastman substantially expanded its investment and production at its Longview, Texas plant before institution of suit, was denied the testimony of a number of important witnesses by death or loss of memory, and was denied access to key documents which had been destroyed or were otherwise unavailable because of the passage of time. It would now be inequitable to enforce plaintiff's claim. *Advanced Hydraulics, Inc.* v. *Otis Elevator Company*, 525 F.2d 477 (C.A. 7, 1975); *Brennan* v. *Hawley Products Co.*, 182 F.2d 945 (C.A. 7), *cert. denied*, 340 U.S. 865 (1950); *Potash Co. of America* v. *International Minerals & Chemical Corp.*, 213 F.2d 153 (C.A. 10, 1954); *Continental Coatings Corp.* v. *Metco, Inc.*, 464 F.2d 1375 (C.A. 7, 1972); *Technitrol, Inc.* v. *Memorex Corp.*, 376 F. Supp.

828 (N.D. Ill. 1974), *aff'd per curiam,* 513 F.2d 1130 (C.A. 7, 1975); *Smith* v. *Sinclair Refining Co.,* 257 F.2d 328, 330 (C.A. 2, 1958); *Baker Mfg. Co.* v. *Whitewater Mfg. Co.,* 430 F.2d 1008 (C.A. 7, 1970), *cert. denied,* 401 U.S. 956 (1971).

3. Plaintiff's failure to sooner institute suit was not excused by the pendency of other patent litigation it was prosecuting. *American Home Products Corp.* v. *Lockwood Manuf. Co.,* 483 F.2d 1120 (C.A. 6, 1973), *cert. denied,* 414 U.S. 1158 (1974).

4. The conclusion of unreasonable and prejudicial delay is applicable to the '792 patent even though it was recently issued because plaintiff purposely and unjustifiably delayed issuance of the '792 patent for eight years in order to extend its monopoly on the use of the catalyst of the '332 patent.

5. The finding in *Ziegler* v. *Phillips Petroleum Co.,* 483 F.2d 858 (C.A. 5, 1973) that the scope of the invention of the '332 patent was limited to a catalyst for the polymerization of the ethylene is binding on plaintiff and plaintiff is estopped to assert that the scope of the '332 patent extends to a catalyst for the polymerization of other monomers, such as propylene. *Iron Ore Co. of Canada* v. *Dow Chemical Co.,* 177 U.S.P.Q. 34 (D.C. Utah 1972), *aff'd,* 500 F.2d 189 (C.A. 10, 1974).

6. Independent of the conclusions concerning the '332 patent in *Ziegler* v. *Phillips, supra,* this Court concludes that the claims of that patent are limited to a catalyst for the polymerization of ethylene and do not extend to propylene.

7. Accordingly, because defendant uses its 409 catalyst to polymerize propylene to solid propylene, or in the case of polyallomer, to produce a modified polypropylene containing no polyethylene, Eastman's 409 catalyst does not infringe any claim of the '332 patent.

8. Plaintiff has failed to prove that the catalyst composition formed from the two components disclosed and claimed in the '332 patent is actually ever formed in the preparation of the 409 Eastman catalyst made from three components. There is no literal infringement of any claim of the '332 patent.

9. The 409 catalyst is not the equivalent of the '332 catalyst for the polymerization of propylene. They differ basically in means, operation and results. The 409 catalyst does not infringe any asserted claim of the '332 patent under the doctrine of equivalents. *Graver Tank & Mfg. Co.* v. *Linde Air Products,* 339 U.S. 605, 608-09 (1950); *Boyden Power Brake Co.* v. *Westinghouse,* 170 U.S. 537, 568 (1898); *Phillips Petroleum Co.* v. *Sid Richardson C & G Co.,* 293 F. Supp. 555, 571 (N.D. Texas 1968), *aff'd,* 416 F.2d 10 (C.A. 5, 1969); *Marvin Glass & Assoc.* v. *Sears Roebuck & Co.,* 448 F.2d 60, 62 (C.A. 5, 1971).

10. The '792 patent is the "process" counterpart to the '332 catalyst patent and requires use of the same catalyst composition as that of '332. Therefore, defendant's propylene process does not infringe claims 22-32 of the '792 patent for the reasons assigned in Conclusions of Law 8 and 9, *supra.* Nor does Eastman's polyallomer process, which makes no polyethylene, infringe any of the asserted polyethylene claims of the '792 patent.

11. Plaintiff has failed to prove that the catalyst composition which is the essential element of the '515 and '162 patents is ever formed in the preparation of the Eastman 409 catalyst. There is no literal infringement of any asserted claims of the '515 and '162 patents.

12. The Eastman 409 catalyst is not the equivalent of the catalysts of the '515 and '162 patents in either the means, operation or results. Hence the 409 catalyst and the use thereof does not infringe any claim of the '162 and the '515 patents under the doctrine of equivalents. (Cases cited, CL 9).

13. The doctrine of file wrapper estoppel prohibits plaintiff from asserting a construction of the claims of the '515 and '162 patents which would embrace the subject matter of the lithium butyl and aluminum trialkyl complex which the applicants removed from the claims of the '515 and '162 patents during prosecution in order to avoid prior art. *Ziegler* v. *Phillips Petroleum Co.*, 483 F.2d 858, 870 (C.A. 5, 1973); *Smith* v. *Magic City Kennel Club, Inc.*, 282 U.S. 784, 790 (1931). Inasmuch as Eastman uses a lithium butylaluminum trialkyl complex in the preparation of the 409 catalyst, plaintiff is estopped to contend that Eastman infringes the '515 and '162 patents.

14. Ziegler et al having given up all claims to any monopoly in the catalyst formed by use of a complex of aluminum trialkyl and lithium butyl, irreversibly dedicated that subject matter to the public. That dedication cannot be reversed and taken away from the public through the guise of totally different patents, e.g., '332 or '792, neither of which contemplate such a catalyst system. See *Sontag Chain Stores* v. *National Nut Co.*, 310 U.S. 281, 289-90, 93

(1940). Consequently, Eastman does not, by using such a dedicated combination, infringe the '332 or '792 patents.

15. The catalysts and processes disclosed in the patents in suit, insofar as they relate to the polymerization of propylene, are either inoperative or make polymers that have no practical utility. Extensive experimentation would be required in order to determine how to make and use the alleged invention. Accordingly, each of the patents in suit, insofar as the claims thereof purport to embrace catalysts or processes for the polymerization of propylene, is invalid because its specification fails to contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise and exact terms as to enable any person skilled in the art to which it pertains, or which it is most nearly connected, to make and use the same. 35 U.S.C. §112. *Corona Cord Tire Co.* v. *Dovan Chemical Corp.*, 276 U.S. 358, 385 (1928); *Libbey-Owens-Ford Glass Co.* v. *Celanese Corp.*, 135 F.2d 138, 145 (C.A. 6, 1943), *cert. denied*, 320 U.S. 744 (1943); *Shelco, Inc.* v. *Dow Chemical Co.*, 322 F. Supp. 483, 517 (N.D. Ill. 1970), *aff'd*, 466 F.2d 613 (C.A. 7, 1972), *cert. denied*, 409 U.S. 876 (1972); *Graver Tank & Mfg.* v. *Linde Air Products Co.*, 336 U.S. 271, 276 (1949); *Phillips Petroleum Co.* v. *Shell Oil Co.*, 166 F.2d 384, 386 (C.A. 5), *cert. denied*, 335 U.S. 817 (1948); *Fruit Treating Corp.* v. *Food Machinery Corp.*, 112 F.2d 119 (C.A. 5), *cert. denied*, 311 U.S. 679 (1940); *Health Products Corp.* v. *Ex-Lax Mfg. Co.*, 22 F.2d 286, 287 (C.A. 2, 1927).

16. Each of the claims of the patents in suit is invalid to the extent it purports to cover catalysts or processes for the polymerization of propylene, because the patent spec-

ifications do not set forth how to make a useful, practical product as required by 35 U.S.C. §101. *General Steel Products Co.* v. *Lorenz,* 204 F. Supp. 518, 523 (S.D. Fla. 1962), *aff'd,* 337 F.2d 726 (C.A. 5, 1964); *Brenner* v. *Manson,* 383 U.S. 519 (1966).

17. Each of the claims of the patents in suit is invalid to the extent it purports to cover catalysts or processes for the polymerization of propylene because the inventors did not set forth in their applications the best mode contemplated by them for the practice of their invention as required by 35 U.S.C. §112. *Benger Laboratories, Ltd.* v. *R. J. Laros Co.,* 209 F. Supp. 639, 644 (E.D. Pa. 1962), *aff'd per curiam,* 317 F.2d 455 (C.A. 3), *cert. denied,* 375 U.S. 833 (1963).

18. The earliest possible effective invention date for claims 22 through 32 of the '792 patent (relating to the polymerization of propylene and higher olefins) is August 3, 1954, the filing date of Ziegler et al's Z 4348 application in Germany wherein propylene polymerization was first disclosed. *Application of Saunders,* 219 F.2d 455, 457 (C.C. P.A. 1955); *Application of Kyrides,* 159 F.2d 1019, 1021-22 (C.C.P.A. 1947). Such polypropylene claims are invalid as anticipated by the disclosure of prior art patent No. 3,582,987, granted to Natta et al with an effective invention date in this country of July 27, 1954. 35 U.S.C. §§102(e) and (g); *James B. Clow & Sons, Inc.* v. *U.S. Pipe & Foundry Co.,* 313 F.2d 46 (C.A. 5, 1963); 35 U.S.C. §§119, 104.

19. The earliest effective invention date in this country to which the '515 and '162 patents are entitled is December 27, 1954. Prior to that date one or more researchers at

the DuPont Company in this country had already invented (conceived of and reduced to practice) the claimed catalyst and process of the '515 and '162 patents, and said DuPont researchers did not abandon, suppress or conceal the invention. Accordingly, the '515 and '162 patents are anticipated by the prior invention of the DuPont researchers and are invalid. 35 U.S.C. §102(g).

20. The U.S. patent No. 2,867,612 issued to Pieper fully describes the inventions of the '515 and '162 patents and has an effective U.S. invention date of October 8, 1954. Accordingly, the '515 and '162 patents with an effective date no earlier than December 27, 1954, are invalid because anticipated by the Pieper patent. 35 U.S.C. §§102(e) and (g); §119; *J. B. Clow* v. *U.S. Pipe & Foundry, supra.*

21. U.S. patent No. 2,905,645 issued to Anderson et al, based on an application filed in the U.S. on August 16, 1954, fully describes or, in view of the known use of lithium butyl as a reducing agent for $TiCl_4$, renders obvious the inventions claimed in the '515 and '162 patents. Accordingly, the '515 and '162 patents are invalid as having been anticipated or rendered obvious in light of the disclosures of the Anderson patent. 35 U.S.C. §§102(e), 103.

22. The earliest effective date for the disclosure in the '515 and '162 patents of a catalyst for the polymerization of propylene or olefins generally is July 1, 1958. 35 U.S.C. §120. By this date that subject matter was already in the public domain as disclosed in British patent 785,314, Belgian patent 543,941, U.S. patent 2,880,199, and Spanish patent 225,790. Accordingly the claims of the '515 and '162 patents, to the extent they purport to cover catalysts and processes for the polymerization of propylene or ole-

fins generally, are invalid. 35 U.S.C. §§102(a), (b) and (e); *Chromalloy American Corp.* v. *Alloy Surfaces Co.*, 339 F. Supp. 859, 874-75 (D. Del. 1972); *Indiana General Corp.* v. *Krystinel Corp.*, 297 F. Supp. 427, 443 (S.D.N.Y. 1969), *aff'd*, 421 F.2d 1023 (C.A. 2, 1970), *cert. denied*, 398 U.S. 928 (1970); *Application of Ruscetta*, 255 F.2d 687 (C.C.P.A. 1958).

23. If the introduction of the "comprising" language in claims 22 through 32 of the '792 patent by amendment of April 30, 1974 is construed to include the presence of additional catalyst components beyond those specifically set forth, then such construction constitutes a broadening of the claim over the prior "formed by" language. *Hoskins Mfg. Co.* v. *General Electric Co.*, 212 Fed. 422 (N.D. Ill. 1914), *aff'd*, 224 Fed. 464 (C.A. 7, 1915); *In re Bertsch*, 132 F.2d 1014 (C.C.P.A. 1943). In such event, the claims are invalid under the doctrine of late claiming, because of the intervening rights established by Eastman through the use of its 409 catalyst and process since at least 1967 and the patenting thereof in 1972. *Webster Electric Co.* v. *Splitdorf Electric Co.*, 264 U.S. 463 (1924); *Chicago & Northwestern Railway Co.* v. *Sayles*, 97 U.S. 554 (1878); *Kahn* v. *Dynamics Corp.*, 367 F. Supp. 63 (S.D.N.Y. 1973), *aff'd*, 508 F.2d 939 (C.A. 2, 1974), *cert. denied*, 421 U.S. 930 (1974); *Phillips Petroleum Co.* v. *Sid Richardson C & G Co.*, 293 F. Supp. 555, 558 (N.D. Tex. 1968).

24. A chemical catalyst and the use of that catalyst are the same invention. (*Ziegler* v. *Phillips*, 483 F.2d 858, 873 (C.A. 5, 1973)). The '162 process patent is merely a second patent for the same invention as the '515 catalyst patent issued to plaintiff two and one-half years earlier.

Only one patent may be granted for a single invention; consequently, the '162 patent is void for double patenting. *Miller* v. *Eagle Mfg.*, 151 U.S. 186, 196-97 (1894); *C-Thru Products, Inc.* v. *Uniflex, Inc.*, 262 F. Supp. 213, 218 (E.D. N.Y. 1966), *aff'd*, 397 F.2d 952 (C.A. 2, 1968); *Southern Implement Mfg. Co.* v. *McLemore*, 350 F.2d 244, 247 (C.A. 5, 1965).

25. If the '792, '515 and '162 patents in suit are construed to embrace the polymerization of propylene using a catalyst wherein the amount of the aluminum component in relation to the heavy metal component is less than a mol ratio of 1 to 1, or if construed to embrace a process using a polymerization temperature in excess of 150°C, the patents would have an effective first filing date of July 1, 1958. As of that date the claims so construed would be invalid as anticipated by the prior art U.S. patent No. 2,880,199, British patent No. 785,314 and Belgian patent No. 543,941. 35 U.S.C. §§102(a), (b); 120.

26. Defendant's counterclaim for breach of confidential duty is dismissed.

27. Defendant's request for reasonable attorneys' fees pursuant to 35 U.S.C. §285 is denied.

ENTERED this 21st day of September, 1977.

/s/ JOE J. FISHER
JOE J. FISHER
CHIEF UNITED STATES DISTRICT JUDGE

Order of Court of Appeals

IN THE

UNITED STATES COURT OF APPEALS

FOR THE FIFTH CIRCUIT

No. 77-3230

STUDIENGESELLSCHAFT KOHL MBH, as Trustee for the MAX-PLANCK-INSTITUT für Kohlenforschung,

Plaintiff-Appellant,

versus

EASTMAN KODAK COMPANY,

Defendant-Appellee.

Appeal from the United States District Court for the Eastern District of Texas

ON PETITION FOR REHEARING
(July 8, 1980)

Before

COLEMAN, Chief Judge,
FRANK M. JOHNSON, JR. and POLITZ, Circuit Judges.

PER CURIAM:

IT IS ORDERED that the petition for rehearing filed in the above entitled and numbered cause be and the same is hereby DENIED.

ENTERED FOR THE COURT:

/S/ JAS. P. COLEMAN
United States Circuit Judge